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# Development of an Emergency Response Program for Transportation of Hazardous Waste

**Envirex, Inc, Milwaukee, WI Environmental Sciences Div**

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# DEVELOPMENT OF AN EMERGENCY RESPONSE PROGRAM FOR TRANSPORTATION OF HAZARDOUS WASTE

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U.S. ENVIRONMENTAL PROTECTION AGENCY

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## TABLE OF CONTENTS

Page

Figures v
Tables vi
Acknowledgements viii

I. Executive Summary 1

II. Introduction 15
- Pertinent Definitions 15
- Project Objectives and Limitations 18
- Spill Scenario 18
- Approach to the Study and Report Format 20

III. Summary of Regulations, Notification Procedures And Reporting Requirements 23
- General 23
- Federal Legislation 23
- State Legislation 34
- Review of Legislation 36
- Summary of Legislation 37

IV. Response Manuals and Information - Capabilities Summary 46
- General 46
- Telephone Contact Organizations 47
- Background Information Sources 52
- Immediate Response Manuals 59
- Complete Response Manuals 70
- Detection/Assessment or Disposal Manuals 75
- General Summary 79

V. Response Teams - Capabilities 94
- General 94
- Federal Response Teams 94
- Industrial Spill Response Groups 98
- Private Industrial Contractors 100

Page

VI. Evaluation of Response Systems 103
General 103
Notification/Reporting Requirements 103
Information Sources and Response Manual Evaluation 105
Response Team Evaluation 119

VII. Summary and Recommended Systems 147
Summary of Various Response Systems 147
Recommended Response Systems for Handling Hazardous Waste Spills 151

VIII. References 168

Appendices

A Background Information A-1
B Waste Streams B-1
C Summary of State Response Programs C-1

## FIGURES

| Number | | Page |
|---|---|---|
| 1. | Typical print-out of Oil and Hazardous Materials Technical Assistance Data System (OHM-TADS). | 49 |
| 2. | Sample of NFPA label for acetyl chloride. | 65 |
| 3. | Typical Entry from DOT's Hazardous Materials - Emergency Action Guide. | 154 |
| 4. | Proposed Table of Contents - Initial Response Manual. | 156 |
| 5. | Proposed Table of Contents - Secondary Response Manuals<br>Volume I - Containment Techniques. | 159 |
| 6. | Proposed Table of Contents - Secondary Response Manuals<br>Volume II - Identification and Assessment. | 162 |
| 7. | Proposed Table of Contents - Secondary Response Manuals<br>Volume III - Treatment and Disposal. | 166 |

## TABLES

| Number | | Page |
|---|---|---|
| 1. | Summary of Federal Legislation related to Spill Response. | 3 |
| 2. | Information Sources and Manuals Reviewed. | 5 |
| 3. | Summary of Response Team Capabilities. | 10 |
| 4. | Summary of State Regulations, Notification and Reporting Requirements. | 39 |
| 5. | Selected Information Retrieval Systems. | 82 |
| 6. | Sources of Information and Assistance for Hazardous Material Spills. | 83 |
| 7. | Some Additional Sources of Background Information. | 87 |
| 8. | Summary of Capabilities of Manuals and Information Services. | 88 |
| 9. | Private Clean-up and Disposal Firms Interviewed for this study. | 102 |
| 10. | Evaluation of Response Sources for Materials Addressed and Immediate Action Procedure. | 121 |
| 11. | Evaluation of Response Sources for Identification and Assessment Procedures. | 125 |
| 12. | Evaluation of Response Sources for Containment and Environmental Hazard Information. | 129 |
| 13. | Evaluation of Response Sources for Clean-up Techniques. | 133 |
| 14. | Evaluation of Response Sources for Audience Addressed and Clarity. | 137 |

Number | | Page
---|---|---
15. | Evaluation of Response Sources for Flexibility, Prior Training and Meeting Stated Objectives. | 141
16. | Summary of Response Team Capabilities. | 145

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# SECTION I

## EXECUTIVE SUMMARY

### Purpose

There exists a great interest in problems associated with hazardous materials spills due to the anticipated increase in transportation of hazardous wastes. New legislation has caused the Environmental Protection Agency's (EPA) Office of Solid Waste to become concerned as to whether existing emergency response systems were capable of handling hazardous waste spills. As a result, the Hazardous Waste Management Division funded this project to survey and summarize the capabilities of existing systems, and evaluate their applicability to hazardous waste spills. Federal and State regulations regarding spill notification, reporting requirements and clean-up procedures were reviewed. Fourteen information sources, eighteen response manuals and five response teams were evaluated in the study.

### Approach

The evaluation required definition of terms critical to the topic. Hazardous wastes are defined in the Resource Conservation and Recovery Act (42 U.S.C. 82 § 6903) as:

> "a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may -
>
> (A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or
>
> (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed".

However, the criteria for establishing if a solid waste is hazardous has not been finalized. The latest draft regulations (March, 1978) were used when evaluating the response systems applicability to waste streams. The basic approach used in this study was that hazardous materials being transported to a disposal facility were hazardous wastes. The wastes could be relatively pure or complex mixtures in liquid, slurry or solid form. Hazardous substances were considered to be those identified under Section 311 (b)(2)(A) of the Federal Water Pollution Control Act of 1972 as amended by the Clean Water Act of 1977 (CWA). DOT hazardous materials were defined in 49 CFR 171.8. For the purpose of this evaluation, the term hazardous materials was used as an all-encompassing term which included hazardous wastes, hazardous substances and DOT hazardous materials.

The approach first involved a basic overview of pertinent Federal and State legislation for potential application to hazardous waste spill incidents. Notification and reporting requirements, containment, clean-up and disposal procedures were considered. An in-depth review of all emergency response legislation was not necessary, since that is being performed under a separate EPA contract (1).

After summation and evaluation of the response manuals, teams and information sources for their applicability to hazardous waste spills, manual additions and developments were recommended. The actual manuals were not to be written as part of this evaluation. Instead a discussion of the proposed contents is presented.

## Legislation

Federal and State legislation has been promulgated in an attempt to handle problems associated with the accidental release of hazardous materials into the environment. The laws reviewed had varying applicability to spills of hazardous wastes.

Federal Legislation. Various Federal laws have been passed which attempt to minimize the possibility of spills and to respond to the potential emergency situation created by a spill event. A summary of the most applicable Federal laws when hazardous waste spills are considered, is presented in Table 1.

Variation in both materials covered by the legislation and required response is extensive. The interpretation of terms within the law is critical in establishing their applicability to hazardous waste spills. Among the important terms are navigable waters and hazardous substances. Land spills of any hazardous material may or may not be covered, depending upon these interpretations.

Notification requirements on a Federal level do vary. There is a toll free number for notification of the National Response Center when spills occur. The Department of Transportation (DOT) requires telephone notification when the severity of a spill meets certain criteria. It may be necessary for the spiller to notify more than one agency, and most laws include significant penalties for failure to notify. Written reports may be filed by either the spiller or government official directing the response. The DOT requires an incident report for all transportation spills of DOT hazardous materials.

Some laws have incorporated provisions for penalty assessment in the event of a spill incident. Fines range up to $50,000,000 under CWA and are used to provide a revolving fund for emergency clean-up. Other laws may have provisions for spill response but money may not be available.

State Legislation. State laws which control spillage of hazardous materials can usually be classified as one of three types: general water pollution legislation; hazardous waste legislation (where the spiller is considered a generator of a hazardous waste) and specific oil/hazardous material

## TABLE 1. SUMMARY OF FEDERAL LEGISLATION RELATED TO SPILL RESPONSE

| | Materials Covered | Applicable to Spills | Notification Requirements | Fines For Non-Notification | Reports | Penalties | Mitigation Responsibility | Funding |
|---|---|---|---|---|---|---|---|---|
| Clean Water Act 1977 (CWA) Section 311 | Oil and 271 Hazardous Substances Specific Quantities | Occurring into and upon navigable waters and adjoining shorelines | EPA Regional Response Center<br>Nat'l. Response Center | $10,000<br>1 yr. prison | written within 60 days | nonremovable $500-5000 up to $5,000,000 | Contingency Plans Required | |
| CWA Section 504 | same | same | | | | | | Cost of clean-up collectible $125/ton $150/ton up to $50,000,000 |
| CWA Section 311 | pollutants or contaminants | Release into Environment | | | | | 2nd Contingency Plan | $10,000,000 |
| Hazardous Materials Transportation Act | Listed hazardous materials--substances or materials which pose a risk to the environment | occurring during transportation | As soon as practical after meeting criteria<br>DOT<br>Center for Disease Control | $10,000 | written within 15 days | $25,000<br>5 yr. prison | -- | -- |
| Resource Conservation and Recovery and Recovery Act (RCRA, proposed) | Hazardous waste as defined by specified criteria | Any unpermitted discharge | National Response Center<br>EPA Regional Response Center | $25,000/day | written within 15 days | $50,000/day | -- | -- |
| Safe Drinking Water | contaminants--physical/chemical biological or radioactive | affecting water supply | -- | -- | -- | $5,000/day | Emergency power and funding available for mitigation | $8,000,000 |
| Ports and Waterways Safety Act (PWSA) | Oil and 271 hazardous substances | Same as CWA | -- | -- | -- | -- | Develop approp. rules and regulations | -- |

spills legislation. Several laws may apply and their overlapping impacts have not been addressed in this report. Most state laws were more general with regard to designation of hazardous materials, spill locations and emergency situations. As a result, States were usually able to provide broader environmental protection and were more applicable to undefined or unspecified hazardous wastes. However, enforcement could be difficult due to funding and staff limitations.

Notification at a state level involved contacts to a 24 hour answering service or calls to people listed on a call sheet. In many states, technical personnel are on-call for spill response on a district or state-wide basis. Response to a notification will vary depending on the state. In some states, response is automatic, while in others the location, quantity and type of material spilled dictate the response. However, in most instances, state personnel do not perform the actual clean-up but instead supervise the operations. Written report requirements varied. Reports were not always required to be submitted by either the spill coordinator or the spiller.

Overview of Legislation. Federal and State regulations rarely conflict since when differences occur the most stringent law prevals. The notification and reporting requirements do vary, although use of the toll free notification number to the National Response Center is an attempt to standardize procedures. Coordination with the State agencies involved is difficult since the in-State notification requirements are variable. Report forms are not standard which results in duplication of effort between Federal and State agencies and more work for the spiller or coordinator.

When considering applicability to hazardous waste spills, State laws are more general and their jurisdiction can often be considered to include hazardous wastes. Federal laws are limited to listed DOT hazardous materials or hazardous substances or oil. They may or may not be applicable to hazardous wastes depending upon the interpretation of the regulations with regard to mixtures. Since hazardous waste spills are anticipated to more frequently contaminate land rather than water, Federal laws have more limitations.

## Response Manuals and Information Sources

Under this study, thirty-two response sources were identified and reviewed by the contractor. Other sources are available, however, those chosen were considered representative of the available resources and could provide an overview of the type of information and systems already in existence. This group of response sources can be divided into five types: 1) Telephone contact sources, 2) Background information sources, 3) Immediate response manuals, 4) Complete response manuals, and 5) Detection/Assessment and disposal manuals. Most have been written to meet certain specific objectives and have done so very effectively. However, since their objectives vary significantly, it is difficult to compare the manuals. Instead they have been summarized with regard to their overall capabilities and then evaluated with respect to their output, ease of use and general applicability to hazardous waste.

Capabilities Summary. Table 2 presents a list of the manuals and

## TABLE 2. INFORMATION SOURCES AND RESPONSE MANUALS REVIEWED

---

### Telephone Contact Organizations

1. Chemical Transportation Emergency Center (CHEMTREC)
2. Transportation Emergency Assistance Plan (TEAP)
3. EPA Oil and Hazardous Materials - Technical Assistance Data System (OHM-TADS)
4. Chlorine Emergency Plan (CHLOREP)
5. Interagency Radiological Assistance Plan (IRAP)
6. Missouri Pacific Railroad
7. Lockhead Information Systems

### Background Information Sources

8. Dangerous Properties of Industrial Materials - N. Irving Sax
9. The Merck Index - M. Windholz
10. Toxic and Hazardous Industrial Chemical Safety Manual
11. Chemical Safety Data Sheets - Manufacturing Chemists Association (MCA)
12. Chemistry of Hazardous Materials - E. Meyer
13. Fire Offices Guide to Dangerous Chemicals - L. W. Bahme
14. Hazardous Materials - L. Schieles and D. Pauze

### Immediate Response Manuals

15. Emergency Handling of Hazardous Materials in Surface Transportation - Bureau of Explosives - Association of American Railroads (AAR)
16. Guidelines to the Handling of Hazardous Materials - D. J. Behrendsen
17. Hazardous Materials Handbook - J. H. Meidl

(continued)

TABLE 2. (continued)

Immediate Response Manuals (continued)

18. Hazardous Materials Safety Manual - State of Minnesota

19. National Fire Codes - Volume 3 - National Fire Protection Association (NFPA)

20. Hazardous Materials - Emergency Action Guide - Department of Transportation (DOT)

21. Handling Hazardous Materials Transportation Emergencies - Training Course DOT/NFPA

22. Chem-cards - MCA

23. Guide on Hazardous Materials - NFPA

24. Tremcards - Redland Purle Ltd.

Complete Response Manuals

25. Chemical Hazards Response Information System - (CHRIS) - United States Coast Guard/DOT (USCG/DOT)

26. Oil and Hazardous Materials Technical Assistance Data System (OHM-TADS) - EPA

27. Manual for Control of Hazardous Material Spills - Volume 1 - Envirex Inc.

28. Water Quality Accident Handbook - New York State

Detection and Disposal Manuals

29. Field Detection and Damage Assessment Manual for Oil and Hazardous Material Spills - EPA

30. Chemical Disposal Technique for Hazardous Materials - United Parcel Service

31. Laboratory Waste Manual - MCA

32. Recommended Method of Reduction, Neutralization, Recovery or Disposal of Hazardous Waste - TRW Systems Group

information sources reviewed in this project. An individual capabilities summary and a listing of pertinent advantages and disadvantages with respect to handling hazardous waste spills and providing human and environmental protection have been developed.

Telephone Response Organizations. These groups offered information regarding the potential hazards of the spilled material within 24 hours through telephone contacts. The most commonly used source was CHEMTREC which is coordinated by the Manufacturing Chemists Association. Other groups are sponsored by industry or the government. Computerized information retrieval services do not provide the fast, direct output needed in an emergency situation.

Background Information Sources. Many different references could be included in this classification. Sources reviewed for this project included toxicity books, data sheets and textbooks to acquaint emergency personnel to hazardous materials problems. The information included was either difficult to access quickly or was not directed spill response. However, the texts were effective in presenting the potential dangers associated with hazardous material spills and in providing the information needed for verification of a given response technique.

Immediate Response Manuals. These manuals provide information necessary to safely handle a spill incident within 30 minutes to 2 hours after its occurrence. They are generally written to a broad audience and provide safety information, first aid techniques and initial response actions to be taken. Many types are available. The information presented can be accessed through either knowledge of the chemical identity or DOT placard type. Preliminary training is not mandatory for effective use although previous familiarity with the contents is desirable. These manuals do not provide sufficient information for a complete response.

Complete Response Manuals. Only three sources were reviewed which attempted to address total response to a spill incident. Even these three had different objectives and scopes, and were difficult to compare. Topics addressed varied considerably. All three presented some discussion of clean-up procedures although the degree of detail varied. Other topics covered by at least one manual were identification, assessment, containment and disposal. The information must always be accessed through the chemical identity.

Detection/Assessment or Disposal Manuals. Only one manual addressed detection/assessment and it was complete. Disposal references either considered small quantities of materials (laboratory or small packages) or the components of the waste streams separately. Knowledge of the chemical identity was needed to access the data.

Evaluation. The response manual/information sources' applicability to hazardous waste spills and protection of human health and the environment were the main evaluation criteria. Other critical considerations included the types of input needed to access the data available, output for initial and secondary response, and ease of use.

Telephone Information Sources. These sources were evaluated for 1) the availability of a computerized data base, 2) access and response time, 3) degree of input required, 4) variety of chemicals addressed and 5) type of output available.

No computerized data base is available with an associated 24 hour access number. Most telephone sources require knowledge of the material identity prior to accessing information, with OHM-TADS the notable exception. This is a severe limitation with respect to unidentified hazardous waste spills. Mixtures are usually not covered in detail and wastes are not addressed at all. Most sources provide output limited to initial response and safety information and possibly the name of the manufacturer. OHM-TADS provides much more information but has limited accessibility and requires technical interpretation prior to application.

Background Information Sources. These sources generally provide technical background information on toxicity or hazards of specific chemicals or an overview of hazards associated with chemical classes. The audience addressed varies from emergency response personnel to technical personnel, depending on the text. These sources are relatively easy to use. Their applicability to mixtures of unidentified hazardous wastes is minimal since the identity of the chemicals must be known before specific information can be accessed.

Immediate Response Manuals. These manuals or cards are characterized by the fact that they are easy to use and present crucial immediate response information needed for human health protection. The data is accessed through chemical name or placard type and the audience addressed is broad. One source, the Redland Purle Tremcards, presents initial response information for classes of hazardous wastes. First aid, containment and other initial response information was included for the waste categories. Of the other manuals, the DOT Emergency Action Guide was most effective. It highlighted the important information and included categories related to both environmental and human protection. However, it addressed only 43 pure chemicals and no hazardous wastes.

Complete Response Manuals. The three complete response manuals reviewed did not address the subject of spill response in a consistent manner. CHRIS provided the most information. With its four volumes it could address different audiences effectively. It provided initial response information in Volume 1, had an excellent chemical property summary in Volume 2 and addressed hazardous assessment in Volume 3. The response methods presented in Volume 4 were not detailed and were limited to in-place treatment of water spills. Volumes 2-4 address a technical audience and will require additional training prior to use. CHRIS' main limitations are that it addresses mainly spills into large water bodies and that the identity of the material spilled must be known prior to accessing this data. It is not applicable to unidentified or mixtures or hazardous wastes.

OHM-TADS computerized approach is desirable since printed information is provided only when needed. There is a tremendous amount of information presented although some details may be missing due to lack of the necessary data base. The output is difficult to access and use and requires technical interpretation. Although an identification technique is available, it is directed to pure chemicals only. Detailed instructions for implementing the clean-up procedures are not included.

The EPA Manual for Control of Hazardous Material Spills - Volume I presents the most information on treatment of the spilled material. Complete directions are limited to water spill treatment in an off stream but on site mode. Notification procedures, a summary of information sources, identification and assessment techniques are also included. Most procedures are directed to pure hazardous substances but can be used for hazardous waste spills with proper interpretation.

None of these three manuals were easy to use and most require technical background and/or a training course. These manuals address the components of a hazardous waste stream but care must be taken when applying the information to mixtures of different chemicals.

Detection/Assessment and Disposal Manuals. Most of the methods presented in the EPA Field Detection and Damage Assessment Manual are applicable to assessing damage associated with hazardous waste spills. However, it does not provide information on other subjects. The other disposal manuals are limited in scope and applicability to hazardous waste spills. The procedures are usually directed to handling small quantities of pure materials. Some technical background is required for most effective use.

## Response Teams

Response Teams can be government or industry sponsored or they can be private organizations involved in spill clean-up and/or disposal. A summary of the capabilities of the government or association sponsored teams is included in Table 3. Private contractors have been reviewed on a more general basis because of the rapidly changing capabilities associated with this group.

In general, most government and industrially sponsored groups are limited in their applicability to hazardous waste spills because either they have expertise for a specific type of chemical or do not address waste materials.

Private contractors, on the other hand, are equipped to handle various types of chemical spills. Their involvement in establishing the control techniques is dependent on the situation and the amount of input available from the OSC or other spill response coordinator. If the proper background and response information is developed, this group would be qualified and equipped to deal with hazardous waste spills.

## Conclusions and Recommendations

The following conclusions can be made:

1. Various laws have been promulgated on both a State and Federal level

# TABLE 3. SUMMARY OF RESPONSE TEAM CAPABILITIES

| | Access | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Response Teams | 24 Hour Telephone | CHEMTREC | Available to General Public | Regional Offices | Materials Covered | Response Time | Consult-On-Site or Remote | Actual Containment | Actual Clean-up |
| National Response Team/Regional Response Team (NRT/RRT) | Yes | No | Yes | Yes | CWA<br>Sec 311 | Varies | Both | No | No |
| U.S. Coast Guard National Strike Force (NSF) | Thru NRC | No | Yes | Yes<br>3 Teams | Oil | 1-2 in 2 hrs<br>4-6 in. 4 hrs<br>Full Team in 12 Hrs | On-Site | Depends on the Situation | |
| U.S. Army Chemical Emergency Team | Yes | No | No | No | Military Chemicals<br>No Explosives | 2 Hours Plus Travel | On-Site Or Remote-More Remote | Reconnaissance | Yes - incineration is common |
| Interagency Radiological Assistance Plan (IRAP) | No | Yes | Yes | No | Radioactive Only | 15 min-1 Hour | Both | Covering | No |
| Chlorine Emergency Plan (CHLOREP) | No | Yes | Yes | Yes | Chlorine Substances | 24 Hours | Both | Stoppage Of Leaks | Stop Leaks Allows Gas To Dissipate |

TABLE 3. (continued)

| Response Teams | Equipment<br>Safety | <br>Containment | <br>Treatment | <br>Other | Funding | Frequency Of Use (Spills/Year) | Comments |
|---|---|---|---|---|---|---|---|
| IRT/RRT | Some | Some | No | Have List Of Available Materials | EPA-Fund With Cost Recovery | Depends On Area | Are Central Coordinator For Spills |
| NSF | Some | Booms, Vacuum Trucks, Pumps Skimmers | No | Use Contractors As Needed | Pollution Fund With Cost Recovery | Varies 2-6/ Month Per Region - Not All Major | |
| U.S. Army Chemical Emergency Team | Some | | 400 Gal Tanks Chemicals Pumps | Special Decontainment Apparatus | Army | No Major Response In 2-3 Years Some Remote Advice | Can Access Through Proper Channels Only |
| IRAP | Special Clothing | | | Radiation Dectors and Counters | Department of Energy | 1 Per Year | |
| CHLOREP | Special Clothing | Capping Devices | Not Applicable | | Chlorine Manufacturers | | |

which regulate response to accidental spills of hazardous materials including many hazardous wastes as defined by EPA.

2. State laws are usually more general and do not specify particular compounds or spill locations. As a result, State laws are more applicable to hazardous waste spills than Federal legislation.

3. Notification and reporting requirements vary with both the state in which the spill occurred and the Federal law which has jurisdiction. The Federal system involves notification to the Natural Response Center through a toll free telephone number. A 24 hour answering service is the prevalent method for receipt of notification in the states, however, technical information is usually not available immediately.

4. Specialized telephone information sources have been developed which provide output ranging from initial hazards to complete response. The chemical identity must be known to access most systems and applicability to unidentified mixtures of hazardous wastes is minimal.

5. Background information sources consisting of chemistry books, toxicity references or firefighters textbooks can be useful sources of verification information during a spill incident.

6. Different types of immediate response manuals provide carriers and emergency response personnel with needed information for the first 30 minutes to two hours after spill response. Knowledge of the chemical identity or hazard classification is needed for access. These manuals are easiest to use, however, they do not address hazardous waste materials.

7. The three complete response manuals reviewed considered various aspects of response. None addressed hazardous wastes and all required knowledge of the chemical identity prior to accessing information.

8. Disposal manuals or references do not address final disposal of large spills and do not include detailed information on disposal mechanisms.

9. Most manuals and information sources have been written to meet specific objectives which they do quite well. Comparison is difficult since the contents, audience addressed and materials covered vary.

10. Hazardous wastes are addressed in only one source - Redland Purle's Tremcards. In most instances knowledge of the chemicals identity is required to access the data.

11. Most of the constituents of waste streams have been addressed in one of the three major complete response manuals; however, direct use of this information could be dangerously misleading when incompatible chemicals in the mixture are being treated. Advice of qualified chemists, in-field testing, as well as directions from a general response manual are necessary to determine an appropriate response

mode. The physical state of the waste (liquid, slurry, solid) must also be taken into account when developing a treatment scheme. This is not currently considered in existing response manuals.

12. Detailed methods for identification of unknown spills and containment of all spills are not presented in the manuals.

13. Spill response teams can be government or industrially sponsored or private third party contractors. The private contractors are equipped to handle a variety of spills and would also be useful for dealing with hazardous wastes spills.

14. Background information regarding the hazards of various waste streams is not available. Waste stream classifications are also not well established.

15. Due to the wide range of audiences who may be involved in various aspects of spill response, it is impossible for the manual to address a single audience and provide response information in sufficient detail.

As a result of the study the following recommendations are made:

1. The 24 hour toll free number should be expanded to allow notification for all spill events. Further notification of State and Federal agencies should be handled through this operator. Some initial response information regarding safety and evacuation procedures should be available at this source.

2. A single reporting format completed by the spiller and the spill coordinator should be devised to compile information on spill occurrence, mitigation efforts and preventative action. Copies should be sent to all appropriate Federal and State agencies.

3. Hazardous wastes should be categorized into classifications which correspond to initial response actions. Variables considered in establishing the categories include; the hazards associated with the waste, its physical form, and its reactions with air, land and water. A corresponding marking system should be developed for display on the outside of transporting vehicles.

4. Immediate response information including evacuation distance and other safety precautions, can be compiled on cards to correspond to the marking system. MCA should be contacted to determine if CHEMTREC can be expanded to provide this information.

5. Typical waste streams or categories should be defined with respect to their toxicity, hazardous effects and treatability. These data should then be compiled into a single readily available background information source.

6. An initial response manual should be developed in a format similar to the DOT Hazardous Materials Emergency Action Guide. The information should be classified according to the hazardous waste categories. Additional chapters on containment, notification and information sources are recommended. This manual should have broad distribution to carriers and emergency response personnel.

7. A secondary response manual should be developed to handle hazardous waste spill incidents. It should have three volumes: Containment; Identification and Assessment; and Clean-up and Disposal. This manual should incorporate or reference pertinent aspects of existing manuals as much as possible to eliminate needless repetition. A training course to aid OSCs, state spill personnel and emergency response personnel should be developed in conjunction with the manuals.

8. The volume addressing containment should present detailed information regarding choice of containment methods, implementation of techniques, and associated safety hazards. This volume would not be specific to hazardous waste spill incidents.

9. The identification and assessment volume should present methods of identifying the hazardous constituents of a waste stream. Techniques could include locating the bill of lading, tracing the processes generating the stream, recognizing certain physical properties and sampling for laboratory analyses. All assessment information should be closely correlated to CHRIS Volume 3 - Hazard Assessment Handbook.

10. The treatment and disposal volume should present methods of correlating available information with the specific spill incident. General handling techniques should be included along with a decision approach for establishing the best control method. If treatment, concentration or detoxification is chosen, in field testing procedures should be used to establish the appropriate treatment schemes.

# SECTION II

## INTRODUCTION

The potential problems associated with the release of hazardous chemicals into the environment are receiving much more emphasis today. New legislation has been promulgated which controls the development and use of toxic and hazardous chemicals, the allowable effluent discharge concentrations and the type of disposal. Accidental releases of hazardous substances into the environment have also been addressed through various statutes on both a State and Federal level.

As more wastes are declared hazardous and require treatment, storage or disposal at specially designated sites, the transportation of these wastes is expected to increase significantly. Concurrently, the potential of accidental spillage of hazardous wastes during transportation also increases. Since EPA was mandated under the Resource Conservation and Recovery Act (RCRA) of 1976 to protect the environment and public health from the dangers associated with hazardous waste, there was increased concern over the potential hazards posed by accidental spills of these generally hazardous materials.

It was recognized that established procedures and laws existed which were utilized to respond to accidental spills of pure compounds. However, the applicability of these resources to reduce hazards and adverse environmental impacts associated with hazardous waste spills was unknown. As a result, this project was performed to evaluate the adequacy of existing response systems to deal with spills of hazardous wastes during transport. In addition, it provides uninitiated personnel involved in hazardous waste transport and handling with an overview of existing regulations and resources available for control of hazardous spills.

### Pertinent Definitions

With the increased concern regarding the uncontrolled release of potentially hazardous chemicals into the environment, there has been promulgation of various laws which attempt to regulate their transportation and handling. Each law has defined a hazardous entity in a different manner. Differentiation of these definitions is important so that the applicability of the laws to hazardous wastes can be understood.

In RCRA (42 U.S.C. 82 § 6903) a hazardous waste is defined as follows:

> A solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may -

> (A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or
>
> (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

A solid waste is defined in the same section as follows:

> Any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under section 1342 of Title 33, or source, special nuclear, or by-product material as defined by the Atomic Energy Act of 1954, as amended (68 Stat. 923).

The draft regulations of Section 3001 dated March 24, 1978 establish criteria for determining if a solid waste is considered hazardous. These criteria result in the classification of solid/hazardous waste into the following categories:

1) Ignitable
2) Corrosive
3) Infectious
4) Reactive
5) Radioactive
6) Toxic

Test procedures are included to allow a determination as to whether a waste meets the given criteria. In addition, a waste is hazardous if it contains a substance listed in the regulation or is a waste listed or produced by processes specified in the regulation.

Since these criteria and list are only available in draft form and are subject to change, the actual definition of a hazardous waste is still nebulous. Therefore, evaluation of the applicability of spill response sources to hazardous wastes is more difficult and somewhat confusing. It may be more helpful to discuss what a hazardous waste is in general. Basically, hazardous wastes during transportation can be differentiated from hazardous materials in that the wastes are being transported for disposal at acceptable sites while pure hazardous materials are designated for commercial use. Hazardous wastes themselves can consist of, among other things, unidentified mixtures of hazardous processing by-products, spoiled batches, or spent chemicals. They can be solid, slurried or liquid. Hazardous wastes can be generated from a continuous process and may be relatively consistent in composition over time, or they may be the result of a series of unrelated batch dumps occurring at random.

Knowledge of the identity of the hazardous components may be the key to establishing the applicability of existing spill response information to waste spill incidents. Most of the known response manuals have been developed for use with pure chemicals. These chemicals may be defined as either DOT hazardous materials or hazardous substances as defined by the 1977 Clean Water Act, Section 311 (b)(2). DOT hazardous materials are defined as follows (49 CFR 171.8):

> 'Hazardous Material' means a substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce and which has been so designated.

Basically, all the materials listed on the DOT Hazardous Materials Table (49 CFR 172.101) are those regulated by DOT.

In contrast, EPA has designated hazardous substances initially specified under the Federal Water Pollution Act of 1972 amended by the 1977 Clean Water Act (CWA). Under authority of this law, the Administrator of EPA is directed to do the following (Section 311 (b)(2)(A)):

> (2)(A) The Administrator shall develop, promulgate, and revise as may be appropriate, regulations designating as hazardous substances other than oil as defined in this section, such elements and compounds which, when discharged in any quantity into or upon the navigable waters of the United States or adjoining shorelines or the waters of the contiguous zone or in connection with activities under the Outer Continental Shelf Lands Act or the Deepwater Port Act of 1974, or which may affect natural resources belonging to, appertaining to, or under the exclusive management authority of the United States (including resources under the Fishery Conservation and Management Act of 1976), present an imminent and substantial danger to the public health or welfare, including, but not limited to, fish, shellfish, wildlife, shorelines, and beaches.

The designation of these hazardous substances was promulgated as 40 CFR 116, of which identified 271 individual chemicals as hazardous substances. These regulations and subsequent parts 117-119 initially scheduled to become effective in 1978, were delayed in the courts. However, the term hazardous substance has definite meaning with regard to spills regulations.

With these definitions in mind, it is apparent that certain hazardous wastes may be included under these other designations and therefore subject to the provisions of appropriate laws (See Section III). However, all hazardous wastes may not be covered under existing definitions.

For the purpose of clarity, it is desirable to establish a term which incorporates all hazardous entities, wastes or pure. For this report, the general term hazardous material will be utilized. DOT specified hazardous materials will be addressed as DOT hazardous materials to allow differentiation. Hazardous wastes, hazardous substances, DOT hazardous materials and other hazardous entities, chemicals or mixtures will be referred to as hazardous materials.

## Project Objectives and Limitations

The major objectives of the project were the following:

1. To review existing regulations for their applicability to hazardous waste spills.
2. To summarize and evaluate notification and reporting requirements on a State and Federal level.
3. To summarize and evaluate the capabilities of emergency response teams, information sources and response manuals for their use in control of hazardous waste spills.
4. To recommend an appropriate type of manual (if needed) for handling hazardous waste spills.

The project effort had certain inherent limitations since its major objective was to evaluate spill response systems for applicability to hazardous waste spills. As a result, an in-depth evaluation of overall State and Federal spill response programs was not attempted and extensive information on a state-by-state basis was not compiled. Similarly the manuals, response teams and information sources reviewed are not all inclusive, although an attempt was made to obtain existing systems made known to the contractor.

Evaluation of emergency response systems has been performed with emphasis on their applicability to hazardous waste spills. General aspects of spill response were included when they were important to spills of any type of material. Since approximately 97% of the waste is transported by highway or rail (2), emphasis was placed on evaluating response systems applicability to land or inland waterway environments.

The final output of the effort was to prepare, if needed, an outline for a proposed manual or modifications to existing manuals which will provide necessary information for effective response to spills of hazardous wastes. The recommended contents of complete emergency response manuals appropriate to hazardous wastes are presented, however, the development of the actual manuals as outlined by the Environmental Protection Agency (EPA) was to be performed separately after the results of this study were completed.

## Spill Scenario

In order to understand the various aspects of spill response and define some pertinent terms used in the report, a brief spill scenario has been developed and the various response functions have been described. The response steps are pertinent to spills of any type of hazardous material once the identity of the material is established. The scenario presents an ideal response to a hypothetical spill situation in order to illustrate the interrelationships between different parts of a response system.

Incident Definition. A tank truck transporting approximately 10,000 gallons of pickle liquor solution enroute to a disposal facility has overturned near the highway. The acidic solution is leaking onto the ground and threatens to contaminate a small river nearby.

Initial Reaction. The first step involves notification of the proper State and Federal authorities. These may include the National Response Center (NRC), Department of Transportation (DOT), State police, State Department of Natural Resources, division of emergency government, fire department or others. The spiller, in this case the truck driver, is legally responsible for proper notification, although the State police at the scene may handle some in-state calls. In most instances, the spiller must leave his name and call-back telephone number for further contacts.

Initial Response. It is assumed that the driver has a bill of lading or other shipping document that establishes both the identity of the material spilled and the generator of the waste. State or Federal response personnel can then advise the on-site representative of the shipper's legal responsibility. Some initial containment actions, such as diking around the truck and near the river, or some type of stream diversion, may be attempted by either state personnel, if on site, or by representatives of the carrier. In mo[illegible]s, action should not be taken unless so advised by knowledgeable person[illegible]

Clean-up. Depending on the information available from the waste generator or already known by State response personnel, some type of clean-up may be undertaken. If the river water is affected, it may be necessary to treat the contaminated water in place (in situ) or contain it and pump it through a special treatment system located near the spill site. The contaminated soil may also be treated and/or excavated and disposed of at proper facilities. The on-site personnel may rely on information sources or appropriate response manuals for determining ways to handle a spill incident. The actual response is to be funded by the spiller who can hire a third party contractor to perform the clean-up. Specialized groups are also available to offer advice but may not be needed when dealing with common materials.

The degree and type of treatment required and the determination of when it is completed is established by the On Scene Coordinator (OSC) who may or may not be at the site of the spill. The OSC is a predesignated Federal representative who is responsible for coordinating the overall spill response. Location of the spill, the identity of the spill and the amount of material spilled are all considered when determining the type of action to be taken and who will coordinate the effort.

Disposal. If the clean-up effort has generated by-products which require additional handling and disposal, this effort is to be coordinated with a representative of the State solid waste group. Proper disposal of the residuals or excavated soil into an acceptable site is crucial when dealing with a spill incident.

Spill Assessment. After the clean-up is performed, various reports may be required depending upon the magnitude of the spill and what hazardous material was involved. The reports may be submitted by the spiller or by the spill response personnel or both. Usually a written report includes information on what happended and why; what type of clean-up was performed and what is being done to prevent a recurrence of this type of incident. Federal or State agencies may also conduct surveys to determine the associated spill damage prior to assessing penalties.

From this basic scenario, the various aspects of a spill response system can be identified. The regulations are of critical importance because they define the materials considered hazardous and establish the required response. Notification and reporting requirements, spill response coordination, penalties and disposal restrictions are usually established by regulation. Since Federal and State agencies may have different requirements and since a broad versus narrow interpretation can have a significant impact on the response, knowledge of the pertinent legislation is important.

Then it is important to determine what information is available to help establish a technically sound method for the cleanup of a spill. This input may come from telephone accessed sources, written texts or written response manuals. Available data must address potential safety hazards, environmental effects, proper containment techniques and effective clean-up and disposal procedures. Finally, it is important to have available groups who can perform the clean-up. These personnel may also offer technical input as needed but mainly are equipped to do the clean-up quickly and efficiently.

These basic mechanisms have been developed or established for dealing with spills of hazardous substances which are shipped as virgin materials. The situation becomes even more complex when dealing with spills of hazardous wastes. In these instances, the identity of the spilled material may not be known which makes safe response extremely difficult if not impossible. Since wastes can be either relatively pure spoiled batches or extremely diverse mixtures, the difficulty of identification also varies. When relatively pure hazardous wastes are involved in a spill and identified, the response procedure is similar to that for a virgin material. However, when unidentified mixtures are involved, the available response systems may not be applicable.

## Approach to the Study and Report Format

The project was approached in several steps. First, pertinent information was reviewed either through a literature search or contacts with appropriate response personnel. From this research, existing system capabilities were summarized and the results are presented in the first section of this report. Then, notification/reporting requirements and response systems were evaluated and criteria were developed to evaluate the types of available output and their ease of use. Existing laws, response manuals and teams were also evaluated for their general applicability to hazardous waste spills and their outputs and ease of use. The final result was a recommended manual format for response to hazardous waste spills.

The report itself has been divided into sections which present a summary and evaluation of the different response systems separately. The following sections have been included.

## SECTION III - SUMMARY OF LEGISLATION, NOTIFICATION PROCEDURES AND REPORTING REQUIREMENTS

This section includes a review of Federal and State legislation for its usefulness in responding to hazardous waste spills. Major Federal laws are outlined and an overview of State laws is also included.

## SECTION IV - RESPONSE MANUALS AND INFORMATION SOURCES - CAPABILITIES SUMMARY

This section presents a brief summary of the capabilities of thirty-two manuals and information sources. These sources have been classified by the contractor into telephone contact sources, background information sources, immediate response manuals, complete response manuals and assessment or disposal manuals. The summaries present a brief description of their objectives and contents along with a listing of pertinent advantages and disadvantages. A final table summarizes the capabilities of the reviewed sources.

## SECTION V - RESPONSE TEAM CAPABILITIES

Three types of response teams were identified: government sponsored, industrial associations and private third party contractors. Brief summaries of different governmental and industrial teams are presented. An overview of third party cleanup contractors and disposal firms is also presented.

## SECTION VI - EVALUATION OF RESPONSE SYSTEMS

The notification/reporting requirements, manuals and information sources, and response teams are evaluated. Applicability to hazardous waste spills, general output, ability to protect the public and environmental health and ease of use were among the criteria considered in the evaluation.

## SECTION VII - SUMMARY AND RECOMMENDED SYSTEMS

The general results of the evaluation are summarized. Then final recommendations and associated justifications are presented. The section also includes a list of questions which are pertinent to the continuing research effort in hazardous waste control.

## APPENDIX A - BACKGROUND INFORMATION

Additional information clarifying manual or information source capabilities is included.

APPENDIX B - WASTE STREAMS

A detailed listing of hazardous waste streams and an indication of how they are addressed by existing complete response manuals is included.

APPENDIX C - SUMMARY OF STATE SPILL RESPONSE PROGRAMS

A brief summary of the effort involving State response programs is included.

# SECTION III

## SUMMARY OF REGULATIONS, NOTIFICATION PROCEDURES AND REPORTING REQUIREMENTS

### General

There have been many different laws which attempt to deal with the problems associated with accidental release of hazardous materials into the environment. These laws have been promulgated on both the Federal and State level and vary significantly in their approach to the problem. In some legislation, the materials and locations covered are very specific while in other instances, only a very broad discussion of hazardous spills is employed. In both circumstances, the degree of response is usually determined by an individual's interpretation of the law and it appears that the final determination of responsibilities will ultimately be made in the courts.

The regulations may or may not require notification (telephone and/or written) or written reports after a spill incident. In some instances, a notification number is available but not required by law. Also the response to a notification will vary, depending upon the circumstances of the spill, so this information is not codified.

This section presents the various Federal and State legislation pertinent to control of hazardous material spills. It does not involve a complete evaluation of statuatory authority, nor is it intended to be all conclusive for every State or possible law which may be applicable. However, it does provide a broad overview of the various legal authorities which allow or mandate response to emergency situations associated with all spills.

### Federal Legislation

In the course of the last several years, Congress has periodically addressed itself to the need for legislation dealing with the dangers to public health and welfare which are inherent in spills or discharges of hazardous materials. The Congressional approach has been to either amend existing, or to expand proposed, environmental legislation. Consequently, the various Federal agencies have used their authority to (1) require those persons under their jurisdiction to abide by the safeguards established by these pieces of legislation to prevent or minimize the possibility of spills of hazardous materials or, (2) in the event of such a spill, to permit a response by the Federal government to the emergency situation created by such a spill.

As a result, many laws have been promulgated which have different authorities with regard to a spill event. The most pertinent with regard to potential spills of hazardous wastes are discussed as follows:

1. The Clean Water Act of 1977 (CWA)
   Public Law 95-217
   33 U.S.C. 1251 et. seq.

2. Hazardous Materials Transportation Act (HMTA)
   Public Law 93-633
   49 U.S.C. 1801 et. seq.

3. Resource Conservation and Recovery Act (RCRA)
   Public Law 94-580
   42 U.S.C. 6901 et. seq.

4. Safe Drinking Water Act (SDWA)
   Public Law 93-523
   as amended by,
   Safe Drinking Water Amendments of 1977
   Public Law 95-190
   42 U.S.C. 300F et. seq.

5. Ports and Waterways Safety Act of 1972 (PWSA)
   Public Law 92-340
   33 U.S.C. 25 1221 et. seq.

### The Clean Water Act of 1977, Public Law, 95-217
### (33 U.S.C. 1251 et. seq.)
### (referred to as CWA)

Section 311 (c)(1) and (2) of the Clean Water Act of 1977, Public Law 95-217, provides for the development of a National Contingency Plan for the removal of oil or hazardous substances which have been discharged, or in instances where there is a substantial threat of such discharge, into or upon the navigable waters of the United States, adjoining shorelines, or into or upon the waters of the contiguous zone of which may affect natural resources belonging to, appertaining to, or under exclusive management authority of the United States. This Act is for all practical purposes silent as to a definition of the term "navigable waters" and adjoining shorelines". However, these terms have been the subject of numerous cases of judicial interpretation. The term navigable waters is defined in Section 502 (7), Public Law 92-500 as "the waters of the United States including the territorial seas".

Navigable waters are generally held to include lakes, rivers, bays, harbors and all waters capable of practicable navigation for useful purposes. A legal encyclopedia would define navigable waterways as waterways which are, or can reasonably be made, suitable for use as a highway for commerce. The term shorelines is almost uniformly held to be those spaces between the normal high and low water marks.

The Contingency Plan is to provide for efficient, coordinated, and effective action to minimize the damage from the oil or hazardous substance. It is to include, but not be limited to:

1) Assignment of duties and responsibilities among federal departments and agencies in coordination with state and local agencies.

2) Identification, procurement, maintenance, and storage of equipment and supplies.

3) Establishment or designation of a strike force consisting of personnel who shall be trained, prepared, and available to provide necessary services to carry out the Plan.

4) A system of surveillance and notice designed to insure earliest possible notice of discharges of oil and hazardous substances to the appropriate federal agency.

5) Establishment of a national center to provide coordination and direction for operations in carrying out the Plan.

6) Procedures and techniques to be employed in identifying, containing, dispersing, and removing oil and hazardous substances.

7) A schedule, prepared in cooperation with the states, identifying (i) dispersants and other chemicals, if any, that may be used in carrying out the Plan, (ii) the waters in which such dispersants and chemicals may be used, and (iii) the quantities of such dispersant or chemical which can be used safely in such waters.

8) A system whereby the state or states affected by a discharge of oil or hazardous substance may act where necessary to remove such discharge and such state or states may be reimbursed from the fund established under this section for the reasonable costs incurred in such removal.

Section 311 (c)(2) Public Law 92-500, mandates that the National Contingency Plan (NCP) include the above eight provisions. The Clean Water Act, Public 95-217, did not delete or alter these provisions.

Section 311 of the Act defines a hazardous substance as a substance designated as such in regulations promulgated by the Administrator of the Environmental Protection Agency in 40 CFR part 116. Section 311 (c)(1) of the Water Pollution Control Act Ammendments of 1972, Public Law 92-500, authorized the President to act to remove or arrange for the removal of oil, or hazardous substances, whenever it is discharged into or upon the navigable waters of the United States, adjoining shorelines or into or upon the contiguous zone. Section 58 (c)(1), Public Law 95-217, the Clean Water Act, expanded the President's authority to act to include those discharges "which may affect natural resources belonging to, appertaining to, or under the exclusive management authority of the United States". The term "natural resources" is not defined in Public Law 92-500 or 95-217. The Contingency Plan, therefore, is limited in applicability by location of discharge, or imminent discharge, i.e., navigable waters, adjoining shorelines, and certain natural resources, and by the substances determined to be hazardous by the

Administrator.

The Act directs the Administrator to develop, promulgate and revise, as may be appropriate, regulations designating as hazardous substances such elements and compounds other than oil which when discharged in any quantity present an imminent and substantial danger to the public health and welfare or which may affect certain natural resources. The Act further mandates that the Administrator is to promulgate regulations which determine the quantities of such hazardous substances which, at such times, locations, circumstances and conditions will be harmful to the public health or welfare of the United States. In response to these mandates, regulations have been promulgated (40 CFR parts 116-119) which list as hazardous substances, substances which meet certain toxicity standards and have a reasonable potential for being discharged. The regulations also establish those quantities of the designated hazardous substances which are to be considered harmful quantities.

Section 311 (b)(5), Public Law 92-500, provides that any person in charge of a vessel or any onshore facility or an offshore facility shall, as soon as he has knowledge of any discharge of oil or hazardous substance immediately notify the appropriate agency of the United States Government of such discharge. 33 CFR 153 provides that the report should be made, in order of priority, to one of the following: Duty Officer, National Response Center or, if that is impractical, then to the On-Scene Coordinator designated in the vicinity of the discharge; or the Commander of the Coast Guard district in which the discharge occurs. The Act provides for a fine of up to $10,000.00, or imprisonment up to one year, for the failure to immediately notify the appropriate agency of a discharge of a hazardous substance.

The primary thrust of the Contingency Plan is to provide a coordinated Federal Response capability at the scene of a discharge which poses a threat to public health or welfare. However, nothing in the Act or regulations is to be construed as pre-empting a state, or political subdivision thereof, from imposing regulations with respect to such discharges. In addition, the states are encouraged to furnish a liaison to the Regional Response Team and required to designate the appropriate element of state government which would undertake direction of state supervised discharge removal operations. USCG and the EPA are to exchange reports between themselves, with reports of major or medium discharges exchanged expeditiously by telephone. Within 60 days following the conclusion of the Federal removal action, the OSC shall submit a report of the response operation and action taken and that report should contain the following information:

1) Description of the cause and initial situation,
2) Organization of response action and resources committed,
3) Effectiveness of the response and removal actions by
    a) The discharger
    b) State and local forces
    c) Federal agencies
4) Unique problems encountered; and
5) Recommendations on
    a) Means to prevent recurrence

b) Improvement of response actions
c) Suggested changes in National or Regional Contingency Plans.

The Act provides that the discharge of hazardous substances - other than discharges which were caused by an act of God, an act of war, negligence on the part of the United States Government, or an act or omission of a third party - will result in civil penalties assessed by the Administrator. If the hazardous substance has been determined to be non-removable by the Administrator, fines are assessed in one of two alternative methods. The first method would result in a penalty based on the toxicity, degradability, and dispersal characteristics of the substance. That penalty would be not less than $500 nor more than $5,000,000. The second method would result in a penalty determined by the number of units discharged multiplied by the amount established by the Administrator for such unit. The penalty would be not more than $5,000 in the case of a discharge from a vessel nor more than $500,000 in the case of a discharge from an onshore or offshore facility. The regulations require the Regional Administrator to consider the size of the discharge, the culpability of the owner, the toxicity, degradability and dispersal characteristics of the substance and the extent of any mitigation or clean-up efforts in deciding which of the two penalty options to impose.

In addition to the penalty mentioned above, the Clean Water Act of 1977, Section 311 (b)(2)(B)(v) provides that the Administrator may act to mitigate the damage to the public health and welfare caused by a discharge of a non-removable substance and that the cost of such mitigation shall be considered a cost of removal and shall be collectable to the extent allowed by this Act. If the discharge is of a removable substance, the owner or operator of a vessel or an onshore or offshore facility shall be liable for the actual costs of the removal of that oil or hazardous substance as follows:

1) When the discharge is from a vessel, as in the case of an inland oil barge, $125 per gross ton of such barge or $125,000, whichever is greater, and in the case of any other vessel, $150 per gross ton or $250,000, whichever is greater.

2) When the discharge is from an onshore facility, an amount not to exceed $50,000,000. Section 311 (1)(10), Public Law 92-500, defines onshore facility as any facility (including, but not limited to motor vehicles and rolling stock) of any kind located in, on, or under, any land within the United States other than submerged land.

3) When the discharge is from an offshore facility, an amount not to exceed $50,000,00. Section 311 (a)(11) Public Law 92-500, defines an offshore facility as any facility of any kind located in, on, or under, any of the navigable waters of the United States other than a vessel or public vessel.

In addition to the powers and duties of the Administrator as enumerated above, he has certain emergency powers which were authorized by Section 504, of the Water Pollution Control Act Amendments of 1972 and expanded by the Clean Water Act of 1977. The Administrator is authorized to provide assistance in emergencies caused by the release into the environment of any pollutant or contaminant. Such assistance may include:

1) The seeking of injunctive relief from the Federal Courts;
2) Measures to abate or remedy the emergency;
3) Research on the effect of an emergency on public health, welfare and the environment; and
4) Officers and employees to administer, at the site of the emergency, federal law to minimize and mitigate the adverse effects of the emergency.

The Administrator is also required to prepare a Contingency Plan, similar to the Contingency Plan established pursuant to Section 311, Public Law 92-500, for responding to these emergencies.

A contingency fund of $10,000,000 to allow the Administrator to carry out the intent of this section of the law was authorized in the Clean Water Act of 1977.

## Hazardous Materials Transportation Act,
## Public Law 93-633
## (49 U.S.C. 1801 et. seq.)

The declared intent of Congress in passing this Act was to improve the regulatory and enforcement authority of the Secretary of Transportation to protect the Nation adequately against the risks to life and property which are inherent in the transportation of hazardous materials in commerce. The concept of "commerce" to which the provisions of this Act are applicable, is any trade, traffic, commerce or transportation, within the jurisdiction of the United States, either between a place in a State and any place outside of such State or which affects trade, traffic, commerce or transportation between a place in a State and any place outside of such State. The term transportation as defined in this Act is any movement of property by any mode, and any loading, unloading or storage incidental thereto.

The hazardous materials which are the subject of this Act are substances or materials in a quantity and form which may pose an unreasonable risk to health and safety or property when transported. The Act mandates that the Secretary shall designate materials as hazardous materials when he determines that the transportation of a particular quantity and form of that material may pose an unreasonable risk to health and safety or property. The materials to be designated as hazardous may include, but need not be limited to, explosives, radioactive materials, etiologic agents, flammable liquids or solids, combustible liquids or solids, poisons, oxidizing or corrosive materials and compressed gases.

The regulations which have been promulgated by the Secretary designate substances in certain tables which list and classify those substances, and the quantity of thereof, which will make them hazardous materials under the Act. In addition there are also various regulations which, addressing themselves primarily to explosives, describe certain chemical properties which, if possessed by the given substance, make it a forbidden material for transportation under the Act even though the substance is not listed by name.

The regulations also contain specific requirements which obligate each carrier who transports these hazardous materials to give notice at the earliest practicable moment after each incident that occurs during the course of the transportation (including loading, unloading, and temporary storage) which gives rise to an emergency situation. These emergency situations are enumerated in the regulations and include:

1) A person is killed;
2) A person receives injuries requiring his hospitalization;
3) Estimated carrier or other property damage exceeds $50,000;
4) Fire, breakage, spillage, or suspected radioactive contamination occurs involving shipment of radioactive material;
5) Fire, breakage, spillage, or suspected contamination occurs involving shipment of etiologic agents;
6) A situation exists of such a nature that, in the judgment of the carrier, it should be reported even though it does not meet the other criteria of this section; e.g., a continuing danger of life exists at the scene of the incident.

The notice is given by telephone to the Department of Transportation or the Center For Disease Control when the incident involves etiologic agents. Each notice must include the following information:

1) Name of reporter;
2) Name and address of carrier represented by reporter;
3) Phone number where reporter can be contacted;
4) Date, time, and location of incident;
5) The extent of injuries, if any;
6) Classification, name and quantity of hazardous materials involves, if such information is available;
7) Type of incident and nature of hazardous material involvement and whether a continuing danger to life exists at the scene.

In addition to the immediate notice the carrier shall report in writing, on forms provided by the Department, within 15 days of each incident. An example form is included in Appendix A, page 53.

The Act provides that violations of the Act or regulations carry civil penalties of not more than $10,000 for each violation, each day of a continuing violation constitutes a separate offense. Willful violations may result in fines of up to $25,000 and/or imprisonment for up to five years. The Act also provides that requirements of State which are inconsistent with the Act or the Regulations are preempted by the applicable provisions of the Act or Regulations.

The Department of Transportation has also proposed regulations, 43 FR 22626, May 25, 1978, which specifically address the transportation of hazardous waste materials. These proposed regulations would apply to offering, transportation and delivery, both interstate and intrastate, of hazardous waste materials. These proposed regulations define hazardous waste as any material which may post an unreasonable risk to health safety or property when transported in commerce for purposes of treatment, storage, or disposal as waste and which is subject to the E.P.A. requirements specified in 40 CFR Part 250. "Hazardous waste" would include presently recognized hazardous materials when shipped as waste and would also include material shipped as waste which is not now recognized as hazardous materials. In the event of a discharge, either accidental or intentional, the proposed regulations would require the carrier to contact by telephone, as soon as practicable either the U.S. Coast Guard National Response Center or the On-scene coordinator in the region in which the incident occurred. The informant would provide the following information:

1) Name of person reporting the discharge.
2) Name and address of carrier.
3) Name and address of generator.
4) Phone number where reporter can be contacted.
5) Date, time and location of incident (indicate pollution of land, water, air or public water supply, if known).
6) Type of vehicle and mode: motor vehicle, air, rail, vessel.
7) Type of incident (fire, breakage, spillage).
8) Proper shipping name, hazard class, and quantity of hazardous waste involved.
9) The extent of injuries.

## Resource Conservation and Recovery Act,
Public Law 94-580
(42 U.S.C.S. 6901 et. seq.)
(Referred to as RCRA)

One of the objectives of the RCRA is the regulation of the treatment, storage, transportation and disposal of hazardous wastes which have an adverse effect on health and the environment. For purposes of this Act the term "hazardous waste" means a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical or infectious characteristics may cause, or significantly contribute to an increase in mortality or serious irreversible or incapacitating reversible illness or pose a substantial present or potential hazard to human health or the environment. Solid waste is defined as any garbage, refuse, or sludge from a waste treatment plant, water supply treatment plant or air pollution control facility or other discarded material including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining and agricultural operations and from community activities. Specifically excluded are solid or dissolved materials which are subject to the permit system established by the Federal Water Pollution Control Act or addressed by the Atomic Energy Act of 1954. RCRA directs the Administrator of the Environmental Protection Agency to develop and promulgate criteria for identifying the characteristics of hazardous waste and for listing hazardous wastes. The Administrator is to take into consideration toxicity, persistence, degradability in nature, potential for accumulation in tissue, flammability, and corrosiveness. He is also to establish a permit system for treatment, storage and disposal of hazardous wastes. Standards applicable to transporters of hazardous waste are to be consistent with the requirements of the Hazardous Materials Transportation Act.

The Act requires the Administrator to promulgate regulations, applicable to transporters of hazardous wastes, as may be necessary to protect human health and the environment. The Environmental Protection Agency has proposed Regulation, 43 FR 18506, April 28, 1978, define "Hazardous material" as a substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety and property when transported in commerce, and which has been so designated in the regulation. A "spill" is defined as any accidental discharge of a hazardous waste onto or into the land or water. The proposed regulations provide that, in the event of a spill the transporter shall:

1) Telephone the National Response Center, U.S. Coast Guard or the On-Scene Coordinator designated by the applicable regional contingency plan.

2) Furnish the following information:

    i) Name of person reporting spill
    ii) Name and address of transporter
    iii) Name and address of generator
    iv) Phone number where reporter can be contacted
    v) Date, time and location of incident
    vi) Type of transport vehicle and mode
    vii) Type of incident
    viii) Classification, name and quantity of hazardous waste involved
    ix) Extent of injuries

3) File written report with the Office of Hazardous Materials Operations, within 15 days.

The Administrator is to work with states in an attempt to develop programs in the states, or to conform existing state programs, to comply with the Act. States may not impose regulations which are less stringent than those in this Act. If the Administrator determines the existence of a violation of the regulations, he must give notice of the violation to either the violator or the state, if the state is administering the program established by this Act. If the violation extends for more than 30 days following the notification, the Administrator may issue an appropriate Order or may commence a civil action. Civil penalties or not more than $25,000 per day of noncompliance may be imposed. Criminal penalties for knowingly violating the Act of not more than $25,000 per day and/or up to one year of imprisonment for the first violation and not more than $50,000 per day and/or up to two years of imprisonment for subsequent violations may be imposed.

### Safe Drinking Water Act, Public Law 93-523, As Amended By, Safe Drinking Water Amendments of 1977, Public Law 95-190
### (42 U.S.C.S. 300f et. seq.)

This Act directs the Administrator of the Environmental Protection Agency to promulgate primary and secondary drinking water regulations. The primary drinking water regulations are, by definition, regulations which apply to public water systems, specifying contaminants which may have an adverse effect on the health of a person, further specifying maximum allowable levels of those contaminants in those systems, and containing criteria and procedures to assure a supply of drinking water which dependably complies with such maximum contaminant levels. The secondary drinking water regulations are those which apply to public water systems and which specify the maximum contaminant levels which are requisite to protect the public welfare. These regulations may apply to contaminants which adversely affect the odor or appearance of such water. The term contaminant means any physical, chemical, biological or radiological substance or matter in water.

States are to have primary enforcement responsibilities during any period that the State has regulations which are no less stringent than the regulations established under this Act. If the Administrator determines that the state is failing to enforce the regulations, he should so notify the state of such failure and provide appropriate advice and technical assistance to the State to bring its system into compliance. Each owner or operator of a public water system shall give notice to persons served by it of any failure of the system to comply with the regulations. If the noncompliance extends beyond 60 days following the notice, then the Administrator may commence a civil action to require compliance.

The Act, and its Amendments, grants certain emergency powers to the Administrator. They provide that the Administrator, upon receipt of information that a contaminant which is present in, or is likely to enter a public water system, may present an imminent and substantial endangerment to the health of persons, and that the appropriate State and local authorities have not acted to protect the health of such persons, may take such actions as he may deem necessary to protect the health of such persons. These provisions suspend the usual 60 day period generally allowed a noncomplying system to reach compliance and allow the Administrator to immediately issue such orders as may be necessary to protect the health of persons who are or may be users of the system and to commence a civil action for appropriate relief, including injunctions. Penalties for willful violation of the regulations may not exceed $5,000 per day of violation but the Court may, in any event, enter such judgment as the protection of the public health may require. In addition, the Act now authorizes the Administrator to provide technical assistance and to make grants to assist in responding to and alleviating any emergency situation affecting public water systems (including sources of water for such systems). The grants to be provided are to support actions which are necessary for preventing, limiting or mitigating danger to the public health in an emergency situation and which would not be taken without such assistance. Eight million dollars is authorized to carry out these provisions for emergency assistance in each of the years 1978 and 1979.

### Ports and Waterways Safety Act of 1972 (PWSA)
Public Law 92-340
33 U.S.C. 25 1221 et. seq.

Under Title 11 of this act, the secretary of the Department of Transportation is mandated to establish various rules and regulations which will, among other things, protect navigable waters from environmental harm associated with vessels carrying liquid cargo. The affected cargo includes flammable or combustible materials, oil or the designated hazardous substances from the CWA (40 CFR part 116). Various rules and regulations for vessels are to be set forth as well as establishment of procedures for handling of the material including emergency removal, control and disposition. The law is pertinent to spills on navigable waters and the adjacent shorelines.

Summary of Federal Legislation. General provisions of the various laws are summarized in Table 1. The materials addressed by the different laws vary. The CWA, the Hazardous Materials Transportation regulations and the PWSA address compounds which have been listed as hazardous. CWA and PWSA include the 271 compounds designated by the EPA Administrator as hazardous substances while the Transportation regulations define hazardous materials identified by the Secretary. RCRA addresses hazardous wastes as determined by criteria yet to be established, and the Clean Water Act addresses the broad category of physical, chemical, biological or radioactive contaminants. The only deviation within the law seems to be Section 504 of PL 92-500 which authorizes emergency response for any pollutants or contaminants which are released into the environment.

Hazardous waste may be addressed under legislation other than RCRA. The Clean Water Act may apply if the waste contains greater than a "harmful quantity" of one of the 271 chemicals specified or is considered oil or an oily substance. The same general approach may be applicable under the Hazardous Material Transportation Act. DOT regulations presently included the listed DOT hazardous materials shipped as waste, although the proposed regulations under 43 FR 22626 are more general and would cover most hazardous wastes.

Several of the Federal laws are limited by location. Both CWA and PWSA protect navigable waters and their adjacent shorelines and the Safe Drinking Water Act is pertinent only if a water supply is threatened. The Hazardous Materials Transportation Act and RCRA do not have this type of limitation.

Notification and written reports are only required for certain situations. The Clean Water Act requires that the spiller contact the Regional Response Center, EPA and USCG and authorizes a $10,000 fine for non-notification. Under the Hazardous Materials Transportation Act, an emergency situation must meet certain criteria before DOT is notified by the carrier, although failure to notify could result in a $10,000 fine. The RCRA proposed regulations 43 CR 18506 requires the carrier to notify the National Response Center, the U.S. Coast Guard and the appropriate EPA or USCG On Scene Coordinator. Non-notification involves up to a $25,000 fine per day. Similarly, written reports are required under these three types of legislation.

Penalties can be significant and may be used to keep a revolving fund available for emergency clean-up. Under the CWA several penalty schedules can be applied with fines from $500 - $5,000,000. The cost of clean-up is to be collectable up to $50,000,000. Other fines include $25,000 under the Hazardous Material Transportation Act, $25,000/day under the proposed RCRA, and $5,000/day under the Safe Drinking Water Act. Sources of funding for spill clean-up have been authorized under the CWA with the associated oil and hazardous substances clean-up contingency fund or Section 504.

It should be reemphasized that other federal legislation exists which is associated with the discharge of hazardous materials into the environment, however, they are not as directly applicable to spillage of hazardous chemicals or wastes and have therefore not been included in this review.

## State Legislation

State authority and activities in spill response vary significantly depending on the type of legislation involved, the number of spills usually reported, the staff available for response, etc. Research was conducted to determine the spill response programs and applicable legislation. No attempt was made to contact several in-state agencies to determine their interrelationships since this is being done under a different contract (1). Instead a general summary of the pertinent legislation and spill response procedures was obtained from contacts with either the spill response office of the State or the coordinating agency. During the following discussion, please refer to Table 4 for more detailed information on a state-by-state basis.

Legislation. The type of legislation cited by State coordinators as pertinent could be grouped into three types: general water pollution control, hazardous waste and hazardous/oil spill regulations. The general water pollution laws were most common. Under this authority, spills contribute to the degradation of the water environment and are therefore subject to control. Land spills may be included if groundwater is threatened. Hazardous waste legislation can define a spill as another way to generate a hazardous waste. Therefore, a large classification of materials is covered and location of the spill is not critical. Finally, there may be specific regulations which pertain to spills of oil or other hazardous chemicals. These may or may not be location limited.

Materials addressed in specific legislation highlights an important difference between Federal and State regulations. Most states define a general classification of materials as hazardous vary, but in general an appropriate definition might be: "any substance other than oil, as defined, which when spilled or accidentally discharged into the waters of the State of ________________ threatens the public health or welfare or causes pollution of the receiving waters (3)". Similarly, a spill or an emergency may not be clearly defined. A spill may be defined as "any unlawful discharge or entry of oil or hazardous materials into public waters or waters of the state (4)" and an emergency is considered "a condition that in the exercise of sound discretion of the department is found deleterious to the public health, safety and welfare and requires immediate action (5)". The use of such general definitions make legal interpretation of liability more difficult, but they do allow more encompassing environmental protection. Under these types of definitions, most state spill response coordinators feel that hazardous waste and land spills would be covered under their legislation.

Notification and Reporting. State notification and reporting requirements are also summarized in Table 4. It can be seen that there is a 24 hour telephone number available in most states. However, in most cases, the caller will not receive technical information. Instead a duty officer will determine a call-back number and then relay the call to technical response personnel. These personnel may either be designated as "on call" for a specific time or listed as part of a "call list". In some states, response personnel are required to carry remote "beepers" during non-office hours.

Another approach involves the distribution of lists containing personal telephone numbers of response personnel. The spiller is required to call until someone is notified of the incident. Other requirements include calls to police, civil defense agencies, or the EPA.

Reports. Written reports of the spill clean-up operations by both the spiller and State personnel are always required by approximately twelve States. Other states may use judgment to determine if reports are needed while still others require that only state personnel file reports. In general a spill report must contain the following information: what was the cause of the spill; what containment, clean-up and disposal actions were taken; and what is being done to prevent a similar occurrence. An example format is included in Appendix A, page 55.

Response. Reponse to notification of a spill event also varies. In approximately ten percent of the states someone always responds to a spill. It may be the district spill response personnel or local conservation officer, but every spill is investigated. However, for the majority of states, response personnel take into account the type of material spilled, its quantity, its location and sometimes associated publicity, when determining the mode and degree of response. Some have developed advisory criteria but this is usually not available outside of the agency.

When considering the type of response, it must be recalled that the majority of reported spills are oil or gasoline. Depending on the location, 50-95% of the reported spills are oil. Hazardous chemical spills are most prevalent and severe on the East Coast and in some Southern states according to our research.

Spill Handling. State agency personnel do not commonly become actively involved in the clean-up operations. Only 10-12% of the states indicated that some resources were available for spill clean-up and most resources were limited to oil spill handling. Most state personnel act in supervisory roles only and direct the clean-up operations. The spiller, either an industry or transporter, is required to clean-up the spill or hire a third party contractor to perform the clean-up. The state personnel remain on scene, in most instances, to make certain proper precautions are taken.

## Review of Legislation

Since many different laws are presently involved when a hazardous spill occurs, it is desirable to briefly review the legislation with regard to potential conflicts, general applicability to a wide range of materials and locations, and overall practicality. These areas are of major concern when considering whether or not additional regulations may be necessary which pertain specifically to hazardous waste spills.

Conflicts. The number of direct conflicts between different federal legislation as well as between Federal and State laws is minimized by some standard disclaimers and procedures. Between Federal laws, a disclaimer exists which defers to prior or more stringent regulations. With respect to State and Federal law, the Federal law will take precedence unless the State law is more strict.

Conflicts can occur with respect to who should be notified first and who is in charge at the scene of the spill. Although the contingency plans address the problem by recommending that the states have representation on the Regional Response Team, there is no mandate with regard to direct authority. Another potential conflict within the regulations can exist because of the differences between hazardous substances and DOT hazardous materials. Both EPA and DOT have prepared separate lists which have some overlap but are not consistent. As a result, it may be difficult for the user or carrier to know which regulations are appropriate in the event of a spill.

General Applicability. Both the Hazardous Materials Transportation Act and Section 311 of CWA involve specific designation of hazardous materials or substances. In this manner, they are much more limited than other broader federal legislation and almost all state legislation which covers any hazardous discharge. Location limitations are more difficult to generalize. The most stringent and common regulations are limited to waterways. These can be either listed navigable waters or state waters. If a broad interpretation of waterways is utilized, spills in almost any location can potentially threaten a waterway. In the narrowest sense, listed navigable waters and their adjacent shorelines between the high and low water level are all that are covered in water pollution regulations such as CWA, PWSA, and State water pollution regulations. The list of these navigable waters for each area should be available in the Regional Contingency Plan. The final interpretation will be critical when establishing the eventual applicability of water related legislation regarding spill location.

Land spills are generally covered under the Hazardous Materials Transportation Act if the spill meets given criteria or under the Safe Drinking Water Act if groundwater is threatened. Proposed RCRA regulations cover any land or water spills. State laws vary but more commonly are applicable to land spills threatening surface or groundwater, especially when groundwater is defined as part of the waters of the state. Land and water spills are covered when the state laws consider spillers to be generators of hazardous waste. A breakdown of the pertinent legislation and the type of spill covered is included by state in Appendix C.

Overall Practicality. From the standpoint of understanding, the broad Federal and State laws are difficult to understand and interpret. However in most instances, the specific Federal regulations (such as Section 311 regulations promulgated in 40 CFR parts 116-119) are much clearer and easier to comprehend. These regulations seem to be written for legally uninitiated personnel who must use them. State laws are quite variable with respect to their "readability". When a general water pollution control law is cited, it may be difficult to locate the section most applicable to spill clean-up.

When considering strictly environmental protection, the broad federal laws and general state laws are most effective. However, their implementation and enforcement are extremely difficult. From a legal standpoint, a list of hazardous substances/materials is a much clearer way to address the problems. It is also much simpler for both the manufacturer and shipper to know their responsibilities and obtain the necessary insurance. The listing is not all-inclusive or perfect and may preclude response to spills of toxic materials not yet listed or spills of relatively innocuous materials which may pose a serious environmental hazard (milk/molasses).

## Summary of Legislation

The many laws associated with spills can be extremely confusing to those who may be involved in a spill incident. This is especially true of interstate shippers who are required to comply with both Federal and State spill notification regulations. Other problems occur with regard to type and degree of response mandated, responsibility of both governmental agencies and the spiller for clean-up, and general applicability of spill legislation to different materials and locations. With the implementation of Section 311 of PL 92-500, some of the confusion should be eliminated.

It must be emphasized, however, that under existing regulations, most states are responding to incidents involving spills of any hazardous materials. Most spillers seem to recognize that mitigation is necessary and are willing to accept their responsibility under State direction. As a result, the desired goal has basically been achieved with or without specific regulatory impetus. Whether or not this will continue, when more hazardous waste spills occur, cannot be accurately stated. If the state agencies continue their broad interpretation of laws, hazardous waste spills, at least those affecting or potentially affecting waterways, will be covered.

TABLE 4. SUMMARY OF STATE REGULATIONS, NOTIFICATION AND REPORTING REQUIREMENTS

| State | Pertinent to Spills On: | | | Notification | | | | Response | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Land* | Water | Air | 24 Hr # | Ans.* Service | Home* Call List | Other* | Always Go | Judgment | Criteria |
| Alabama, AL | | X | | | | X | CP | | X | |
| Alaska, AK | | | | | | | | | | |
| Arizona, AZ | AZ | X | | | | X | | | | |
| Arkansas, AR | X | X | X | X | | | DP | X | | |
| California, CA | X | X | X | X | | | | | | |
| Colorado, CO | X | X | | X | | | | | X | X |
| Connecticut, CT | S | X | | X | S | | P | | | X |
| Delaware, DE | X | X | | X | | | | | | |
| Florida, FL | | | | | | | | | | |
| Georgia, GA | | | | X | | | | | | |
| Hawaii, HI | | | | | | | | | | |
| Idaho, ID | | | | | | | E | | X | |
| Illinois, IL | | X | X | S | | | | | | |
| Indiana, IN | X | X | X | X | | | | | X | |
| Iowa, IA | X | X | | X | | | | | | |
| Kansas, KS | X | X | X | X | | X | | | | |
| Kentucky, KY | | | | X | | | | | | |
| Louisiana, LA | | | | X | | | | | | |
| Maine, ME | X | X | | X | S | | | | X | |
| Maryland, MD | X | X | X | X | | | | X | | |
| Massachusetts, MA | X | X | | | S | | | | | |
| Michigan, MI | X | X | | | | | | X | X | |
| Minnesota, MN | X | X | X | X | | | | | | |
| Mississippi, MS | | X | | | | | CP | | X | |
| Missouri, MO | | X | | | | S | | | | |

continued

*Note: S, E, P, AZ, CP, and DP see attached legend.

TABLE 4. (continued)

| State | Pertinent to Spills On: Land | Pertinent to Spills On: Water | Pertinent to Spills On: Air | Notification: 24 Hr # | Notification: Ans. Service | Notification: Home Call List | Notification: Other* | Response: Always Go | Response: Judg-ment | Response: Criteria |
|---|---|---|---|---|---|---|---|---|---|---|
| Montana, MT | X | X |  |  |  | X | C |  | X |  |
| Nebraska, NE |  |  |  |  |  |  |  |  |  |  |
| Nevada, NV | X | X |  |  |  |  |  |  |  |  |
| New Hampshire, NH |  | X |  |  |  |  | P | X |  |  |
| New Jersey, NJ |  | X |  | X |  | X |  |  | X |  |
| New Mexico, NM | X | X | X |  |  |  | S |  | X |  |
| New York, NY | X | X |  | X |  |  |  | X |  |  |
| North Carolina, NC | X | X |  | X |  |  |  |  | X |  |
| North Dakota, ND | X |  |  |  |  |  | ND |  |  |  |
| Ohio, OH | X | X |  | X | X |  |  |  |  |  |
| Oklahoma, OK | X | X |  | X |  |  |  |  |  |  |
| Oregon, OR |  | X |  | X |  |  |  | X |  |  |
| Pennsylvania, PA |  | X |  | X |  |  |  |  |  |  |
| Rhode Island, RI | X | X |  | X |  |  |  | X |  |  |
| South Carolina, SC | X | X | X | X |  |  |  | X |  |  |
| South Dakota, SD | X | X | X |  |  | X |  |  |  |  |
| Tennessee, TN | X | X |  |  |  |  |  |  |  |  |
| Texas, TX |  | X |  | X |  |  |  | X |  |  |
| Utah, UT | X | X | X | X |  |  |  |  |  |  |
| Vermont, VT |  |  |  |  |  |  | S |  |  |  |
| Virginia, VA | X | X |  | X | X |  |  |  |  |  |
| Washington, WA | X | X |  |  | X |  |  |  |  | X |
| West Virginia, WV |  |  |  |  |  |  |  | X | X |  |
| Wisconsin, WI | X | X | X | X |  |  |  |  | X | source known |
| Wyoming, WY | X | X |  |  | S |  |  |  |  |  |

*Note: C, P, S and ND see attached legend.

continued

TABLE 4. (continued)

| State | Handling Spill | | | | Reports | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Supervise | Clean-Up* Team | Hire Contractor | Other | State* | Sometimes | Always | Not Req'd | Criteria* |
| Alabama | X | X | | | | | | | |
| Alaska | | | | | | | | | |
| Arizona | X | | | | | | | | |
| Arkansas | | | | | | | | | AR |
| California | X | | X | | | | | | |
| Colorado | X | CO | | | C | | | | |
| Connecticut | X | | X | | X | | X | | |
| Delaware | X | | | | | | X | | |
| Florida | | | | | | | | | |
| Georgia | X | | | | | X | | | GA |
| Hawaii | | spills handled by U.S.C.G. only | | | | | | | |
| Idaho | X | | | by ind. | X | | X | | |
| Illinois | X | | | | X | | | | |
| Indiana | | | X | | | | | X | |
| Iowa | X | | | | | | | | |
| Kansas | X | | X | | X | | X | | |
| Kentucky | X | | | | | | X | | |
| Louisiana | | | | | | | | | |
| Maine | | X | | | | | for oil | | |
| Maryland | X | X | X | | | | X | | |
| Massachusetts | X | | X | | | | | | |
| Michigan | X | | | | X | | X | | |
| Minnesota | X | | | | | | | | |
| Mississippi | X | | X | | | | | | |
| Missouri | | | | | | | | X | |

*Note: AR, GA, CO and C see attached legend.

continued

TABLE 4. (continued)

| State | Handling Spill |  |  |  | Reports |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|
|  | Super-vise | Clean-Up Team | Hire* Contractor | Other* | State | Some-times | Always | Not Req'd | Criteria* |
| Montana |  |  |  | MT |  |  |  |  |  |
| Nebraska |  |  |  |  |  |  |  |  |  |
| Nevada |  |  |  |  | X |  |  |  |  |
| New Hampshire | X | X |  | private decision |  |  |  |  |  |
| New Jersey | X |  | X |  | X |  | X |  |  |
| New Mexico | X | X |  | NM | X | X |  |  |  |
| New York | X |  | X |  | X |  |  |  |  |
| North Carolina | X |  |  |  | X | X |  |  |  |
| North Dakota |  |  | X |  |  | X |  |  |  |
| Ohio |  |  | X |  |  |  |  |  |  |
| Oklahoma | X |  | X |  |  |  |  |  |  |
| Oregon | X |  | X |  |  |  |  |  |  |
| Pennsylvania |  |  |  |  |  |  |  |  |  |
| Rhode Island | X |  | X | RI | X |  |  |  |  |
| South Carolina | X |  | X | private decision |  |  |  |  | SC |
| South Dakota | X |  |  |  |  |  |  |  |  |
| Tennessee |  |  | X |  |  |  |  |  | TN |
| Texas |  |  | TX |  |  |  | X |  |  |
| Utah | X |  |  |  | X | X | X |  |  |
| Vermont |  |  | X |  |  | X |  |  |  |
| Virginia |  |  | X |  |  |  |  |  |  |
| Washington |  |  |  |  |  |  |  |  |  |
| West Virginia | X |  | X |  | X |  | X |  |  |
| Wisconsin | X | X | X |  | X |  | X |  |  |
| Wyoming |  |  |  |  | WY |  |  |  |  |

*Note: MT, NM, RI, SC, TN, TX and WY see attached legend.

continued

TABLE 4. (continued)

| State | Type of Regulations | | | | | Haz. Matls List | Definitions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Haz. Spill | Haz. Waste | Water Pollution | Oil* | Other | | Toxic Material | Haz. Waste | Haz. Spill | Haz. Material | Oil |
| Alabama | | | | | | | | | | | |
| Alaska | | | | | | | | | | | |
| Arizona | | | | | | | | | | | |
| Arkansas | X | | | | X | | | | | X | |
| California | | X | | | | X | X | X | | X | |
| Colorado | | | X | | X | | | | | | |
| Connecticut | | | | X | | | | | | X | X |
| Delaware | | | | X | | | | | | | X |
| Florida | | X | | | | | | | | | |
| Georgia | | | | | | | | | | | |
| Hawaii | Spills handled thru U.S.C.G. | | | | | | | | | | |
| Idaho | | | | | | | | | | | |
| Illinois | X | | X | | | | | | | | |
| Indiana | | | | | X | | | | | | |
| Iowa | | | | | | | | | | | |
| Kansas | | | X | | | | | | | | |
| Kentucky | X | | | | | | | | | | |
| Louisiana | | | | | | | | | | | |
| Maine | | | X | ME | | | | | | | X |
| Maryland | | | X | | | | X | | X | | X |
| Massachusetts | | X | X | | | | | X | | | X |
| Michigan | | | X | X | | | | | | | X |
| Minnesota | | | | | | | | | | | |
| Mississippi | | | | | X | | | | | | |
| Missouri | | | | | X | | | | | | |

*Note: ME see attached legend.

continued

TABLE 4. (continued)

| State | Type of Regulations |  |  |  |  | Haz. Matls List | Definitions |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Haz. Spill | Haz. Waste | Water Pollution | Oil | Other |  | Toxic Material | Haz. Waste | Haz. Spill | Haz. Material | Oil |
| Montana |  |  | X |  |  |  |  | X |  |  |  |
| Nebraska |  |  |  |  |  |  |  |  |  |  |  |
| Nevada |  |  |  |  |  |  |  |  |  |  |  |
| New Hampshire |  |  | X | X |  |  |  |  |  |  | X |
| New Jersey | X |  |  | X |  | X |  |  | X | X | X |
| New Mexico |  | X |  |  |  | X | X | X | X |  |  |
| New York |  |  |  |  |  |  |  | X |  |  |  |
| North Carolina |  |  |  | X |  |  |  |  |  |  | X |
| North Dakota |  |  |  |  |  |  |  |  |  |  |  |
| Ohio |  |  |  |  |  |  |  |  |  |  |  |
| Oklahoma |  |  | X |  |  |  |  |  |  | X | X |
| Oregon |  |  |  |  | X |  |  |  |  |  | X |
| Pennsylvania |  |  | X |  | X |  |  |  |  | X |  |
| Rhode Island |  |  |  | X |  |  |  |  |  |  |  |
| South Carolina |  |  |  | X |  |  |  |  |  |  | X |
| South Dakota |  |  | X |  |  |  | X | X |  |  |  |
| Tennessee |  |  |  |  |  |  |  |  |  |  |  |
| Texas |  | X |  | X |  |  |  |  | X | X | X |
| Utah |  |  | X |  |  |  |  |  | X | X | X |
| Vermont |  |  |  |  |  |  |  |  |  |  |  |
| Virginia |  |  | X |  |  |  |  |  |  |  |  |
| Washington |  |  | X | X |  |  |  |  |  |  | X |
| West Virginia |  |  | X |  |  |  |  |  |  |  |  |
| Wisconsin |  | X |  |  |  |  |  | X | X |  |  |
| Wyoming |  |  |  | X |  |  | X |  |  | X | X |

continued

TABLE 4. (continued)

LEGEND

P - notify state police
E - notify the U.S. EPA
C - notify civil defense
S - notify state environmental protection agency (or equivalent)
D - notify Department of Transportation
AR - No written report required for the state, however must file an EPA region IV report
GA - Handled on a case-by-case basis
CO - Frequently the state highway department cleans up
ME - Regulations concern themselves with non-emergency spillage. Hearings are held on corrective action to be taken.
CT - Reports contain: time, locale, type, quantity, cause & pertinent parties, Connecticut has a set form.
AZ - A spill on land is left untouched unless it is toxic or threatens any natural waters.
NM - action as deemed necessary
SC - all illegal discharges
WY - state approval of actions
MT - companies clean up
ND - notification is not distributed very well
RI - companies clean up
TN - reporting are handled on a case-by-case basis
TX - industrial co-op will assist in clean-up efforts

## SECTION IV

## RESPONSE MANUALS AND INFORMATION SOURCES - CAPABILITIES SUMMARY

### General

Various response manuals and information sources have been developed which give response personnel technical input regarding both the hazards associated with a spill and methods to mitigate the problem. Most have been developed to meet certain specific objectives and only a few have attempted to address spill response from identification and containment through disposal. Most response manuals have also been prepared for use with spills of virgin materials, not mixtures or wastes and as a result, have inherent limitations when dealing with hazardous waste spills.

The different resources which are available can be grouped into five main categories:

1. Telephone Contact Organizations - These groups are generally accessed by telephone and give various information to the caller within 24 hours.

2. Background Information Sources - These are generally toxicology references or textbooks which are used to train those who respond to hazardous spills. They give additional information regarding hazards or confirm the general handling approach which has been proposed.

3. Immediate Response Manuals - This category includes those manuals which present information to people initially at the scene of a spill incident. The applicable time of use would be the first 30 minutes to two hours.

4. Complete Response Manuals - These manuals have a much broader scope and attempt to address most aspects of spill response including hazard assessment, containment methods, cleanup techniques and disposal procedures.

5. Detection/Assessment of Disposal Manuals - These manuals either address the problems associated with assessing the overall damage caused by a spill incident or present various methods for disposal of hazardous chemicals.

A summary of the capabilities of response manuals and information sources which meet these criteria is included in this section of the report. They are evaluated in Section VI. As many manuals and information sources as possible have been included, although others may become available. It is felt that those included in this review are representative of the pertinent resources.

## Telephone Contact Organizations

Various groups have been established which can offer technical information regarding a spill over the telephone. These groups are generally supported by industrial associations or the government, although some commercial information retrieval systems are available. (Table 5 lists selected information retrieval systems). Due to the critical element of time in an emergency situation, the speed of response is crucial. The quicker the response time the better, and it was felt that response times greater than 24 hours are unacceptable in a spill situation. Therefore, most commercial information retrieval systems are not appropriate spill response sources since they cannot respond in 24 hours. Specialized systems have been developed which meet the needs of those involved with spill response. These and one information retrieval system with a relatively fast response time are discussed. Sources of telephone information and assistance for hazardous material spills are listed in Table 6 with the associated telephone numbers.

Chemical Transportation Emergency Center (CHEMTREC). CHEMTREC serves as a central clearing house to which spillers can call and get immediate warnings and limited advice for some 3,600 mainly virgin materials which are on file. Available information is provided by the producers and other members of the Manufacturing Chemists Association (MCA). It is generally limited to safety procedures and the hazards associated with a spill of a given chemical. After receiving notification of a spill, the CHEMTREC operator will contact the shipper of the materials involved who will then take responsibility for further assistance or other needed followup.

The CHEMTREC 24 hour telephone number is widely distributed to emergency personnel and carriers throughout the chemical industry. A caller who contacts CHEMTREC should provide: 1) name and call-back number, 2) location of the problem, 3) shipper or manufacturer, 4) container type, 5) rail car or truck number, 6) carrier name, 7) consignee and 8) local conditions. The CHEMTREC operator must have the chemical or trade name of the materials to access the manual system. Few mixtures are addressed and the system is only applicable to relatively pure or identified hazardous wastes at this time.

The service is intended for drivers of vehicles or others first on the scene. It is sponsored and operated by the MCA but is open to other users. Response time is very fast since the response information is usually transmitted in the first telephone call.

CHEMTREC is not an all encompassing information source and is not intended to be. Its function is as a liaison between the spiller or a person at the site of the spill and the knowledgeable manufacturer. It is also a contact for the Chlorine Institute, the National Agricultural Chemicals Association and the Department of Energy when materials covered by these groups are involved.

Transportation Emergency Assistance Plan (TEAP). TEAP functions in Canada under sponsorship of the Canadian Chemical Producers' Association (CCPA) in a similar manner to CHEMTREC in the United States. TEAP has control centers in eight geographic areas in Canada, which are attended on a 24-hour basis. Information is provided by the chemical manufacturers and seldom addresses hazardous wastes.

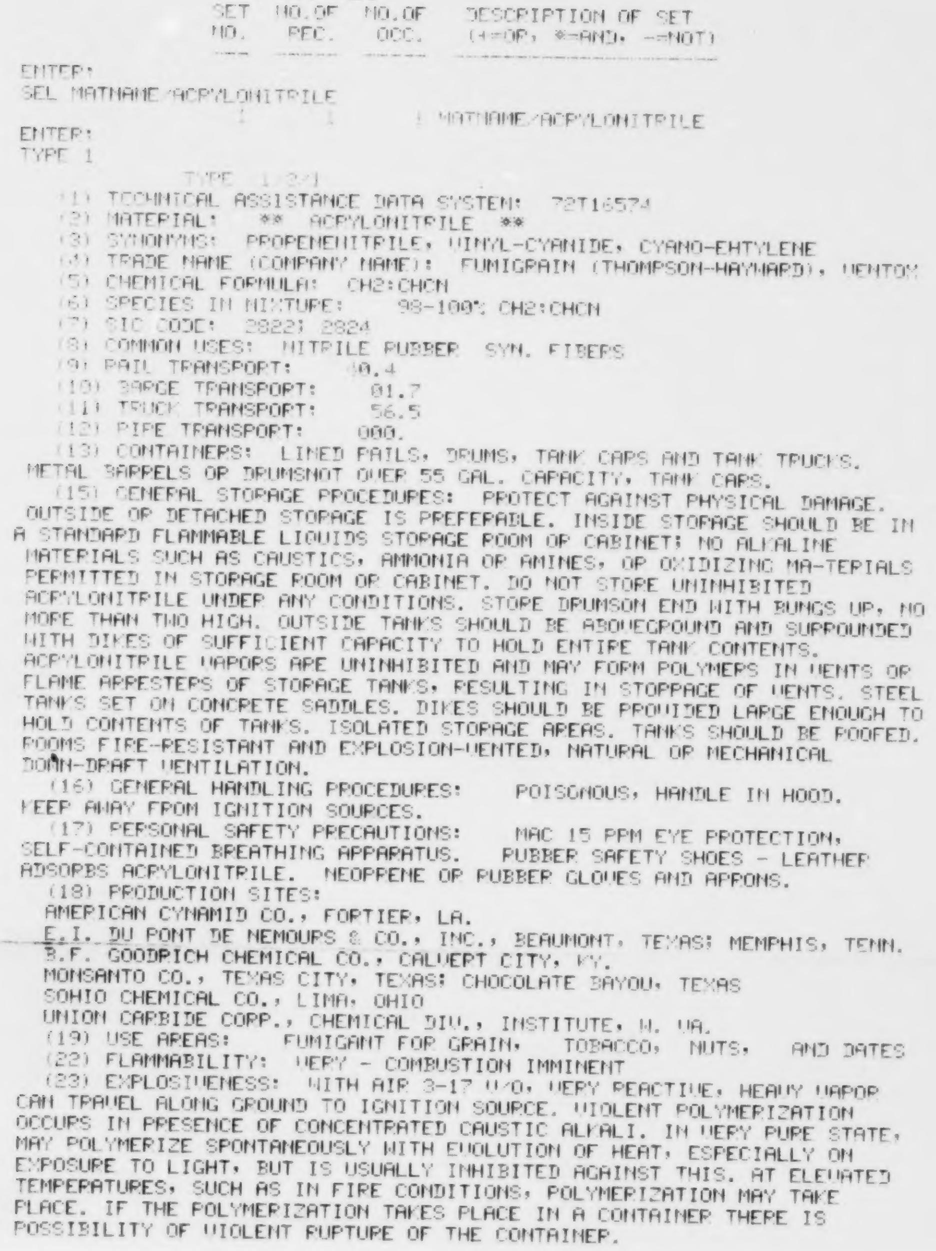
A caller should contact TEAP and provide them with 1) the name of the product spilled, 2) the name of the producer, 3) the name of the carrier, and 4) the owners name and call-back number. After preliminary information regarding hazards is manually retrieved and immediately transmitted, the TEAP attendant then contacts a previously designated technical advisor who takes over the response. This advisor contacts the accident scene to determine more details and then provide additional advice. The advisor will notify the producer who is to handle the problem from that point. If the actual producer is not available or too distant, the advisor will contact a different company familiar with the product. If needed, the TEAP center will send people and equipment to the site. After a producer liaison is established, TEAP advisors assume a follow-up role and notify CCPA of the incident.

Oil and Hazardous Materials Technical Assistance Data System (OHM-TADS). OHM-TADS is a computerized data retrieval system which provides a variety of response information for approximately 1,000 chemicals. The data available includes information on the toxicity and other associated hazards, personnel safety precautions, identification, clean-up and disposal methods, materials handling considerations and firefighting instructions, among others. However, not all information is available for all materials. An example of part of a typical print-out is shown in Figure I.

OHM-TADS is accessed through the Regional Response Center or other paid accounts contracted through time sharing software contractors. It is available from 8 a.m. - 10 p.m. on weekdays and 8 a.m. - 4 p.m. on Saturdays. Turnaround time is extremely rapid with hard copy printout as needed. The user should have some technical background to understand the output. Since OHM-TADS provides complete response information, a more detailed description of the system is presented later in this section.

Missouri Pacific Railroad Information System. The Missouri Pacific railroad has developed a computer handling system for providing immediate information on various DOT hazardous materials. It is accessed through the railroad and provides basic firefighting, containment and evacuation procedures for these chemicals. It is primarily used in the event of derailments to provide fast instructional information.

Chlorine Emergency Plan (CHLOREP). This group is accessed through CHEMTREC and will provide emergency assistance in the event of a chlorine spill. It is associated with the Chlorine Institute and involves a mutual aid function in that a manufacturer closest to a spill scene will provide the necessary input. (See Section V for more information). CHLOREP will



```
                 SET  NO.OF  NO.OF   DESCRIPTION OF SET
                 NO.   REC.   OCC.   (+=OR, *=AND, -=NOT)
                 ---  -----  -----  --------------------------
ENTER:
SEL MATNAME/ACRYLONITRILE
                  1      1        1 MATNAME/ACRYLONITRILE
ENTER:
TYPE 1
             TYPE  1/2/1
   (1) TECHNICAL ASSISTANCE DATA SYSTEM:  72T16574
   (2) MATERIAL:   **  ACRYLONITRILE  **
   (3) SYNONYMS:  PROPENENITRILE, VINYL-CYANIDE, CYANO-EHTYLENE
   (4) TRADE NAME (COMPANY NAME):  FUMIGRAIN (THOMPSON-HAYWARD), VENTOX
   (5) CHEMICAL FORMULA:  CH2:CHCN
   (6) SPECIES IN MIXTURE:    98-100% CH2:CHCN
   (7) SIC CODE:  2822; 2824
   (8) COMMON USES:  NITRILE RUBBER  SYN. FIBERS
   (9) RAIL TRANSPORT:    40.4
   (10) BARGE TRANSPORT:    01.7
   (11) TRUCK TRANSPORT:    56.5
   (12) PIPE TRANSPORT:    000.
   (13) CONTAINERS:  LINED PAILS, DRUMS, TANK CARS AND TANK TRUCKS.
 METAL BARRELS OR DRUMSNOT OVER 55 GAL. CAPACITY, TANK CARS.
   (15) GENERAL STORAGE PROCEDURES:  PROTECT AGAINST PHYSICAL DAMAGE.
 OUTSIDE OR DETACHED STORAGE IS PREFERABLE. INSIDE STORAGE SHOULD BE IN
A STANDARD FLAMMABLE LIQUIDS STORAGE ROOM OR CABINET; NO ALKALINE
 MATERIALS SUCH AS CAUSTICS, AMMONIA OR AMINES, OR OXIDIZING MA-TERIALS
 PERMITTED IN STORAGE ROOM OR CABINET. DO NOT STORE UNINHIBITED
 ACRYLONITRILE UNDER ANY CONDITIONS. STORE DRUMSON END WITH BUNGS UP, NO
 MORE THAN TWO HIGH. OUTSIDE TANKS SHOULD BE ABOVEGROUND AND SURROUNDED
 WITH DIKES OF SUFFICIENT CAPACITY TO HOLD ENTIRE TANK CONTENTS.
 ACRYLONITRILE VAPORS ARE UNINHIBITED AND MAY FORM POLYMERS IN VENTS OR
 FLAME ARRESTERS OF STORAGE TANKS, RESULTING IN STOPPAGE OF VENTS. STEEL
 TANKS SET ON CONCRETE SADDLES. DIKES SHOULD BE PROVIDED LARGE ENOUGH TO
 HOLD CONTENTS OF TANKS. ISOLATED STORAGE AREAS. TANKS SHOULD BE ROOFED.
 ROOMS FIRE-RESISTANT AND EXPLOSION-VENTED, NATURAL OR MECHANICAL
 DOWN-DRAFT VENTILATION.
   (16) GENERAL HANDLING PROCEDURES:    POISONOUS, HANDLE IN HOOD.
 KEEP AWAY FROM IGNITION SOURCES.
   (17) PERSONAL SAFETY PRECAUTIONS:    MAC 15 PPM EYE PROTECTION,
 SELF-CONTAINED BREATHING APPARATUS.   RUBBER SAFETY SHOES - LEATHER
 ADSORBS ACRYLONITRILE.  NEOPRENE OR RUBBER GLOVES AND APRONS.
   (18) PRODUCTION SITES:
   AMERICAN CYNAMID CO., FORTIER, LA.
   E.I. DU PONT DE NEMOURS & CO., INC., BEAUMONT, TEXAS; MEMPHIS, TENN.
   B.F. GOODRICH CHEMICAL CO., CALVERT CITY, KY.
   MONSANTO CO., TEXAS CITY, TEXAS; CHOCOLATE BAYOU, TEXAS
   SOHIO CHEMICAL CO., LIMA, OHIO
   UNION CARBIDE CORP., CHEMICAL DIV., INSTITUTE, W. VA.
   (19) USE AREAS:    FUMIGANT FOR GRAIN,   TOBACCO,  NUTS,   AND DATES
   (22) FLAMMABILITY:  VERY - COMBUSTION IMMINENT
   (23) EXPLOSIVENESS:  WITH AIR 3-17 V/O, VERY REACTIVE, HEAVY VAPOR
 CAN TRAVEL ALONG GROUND TO IGNITION SOURCE. VIOLENT POLYMERIZATION
 OCCURS IN PRESENCE OF CONCENTRATED CAUSTIC ALKALI. IN VERY PURE STATE,
 MAY POLYMERIZE SPONTANEOUSLY WITH EVOLUTION OF HEAT, ESPECIALLY ON
 EXPOSURE TO LIGHT, BUT IS USUALLY INHIBITED AGAINST THIS. AT ELEVATED
 TEMPERATURES, SUCH AS IN FIRE CONDITIONS, POLYMERIZATION MAY TAKE
 PLACE. IF THE POLYMERIZATION TAKES PLACE IN A CONTAINER THERE IS
 POSSIBILITY OF VIOLENT RUPTURE OF THE CONTAINER.
```

Figure 1. Typical print-out of Oil and Hazardous Materials Technical Assistance Data System (OHM-TADS).

```
  (24) AIR POLLUTION:  EXTREME
  (25) ACTION LEVELS:    NOTIFY FIRE AND AIR AUTHORITY.   EVACUATE
IMMEDIATE AREA AND WARN CIVIL DEFENSE OF POTENTIAL EXPLOSION.
  (26) FIELD DETECTION LIMIT (PPM), TECHNIQUES, REF:    10, CARBOXYLIC
ACID RADICAL, BNW, 420171
  (27) LAB DETECTION LIMIT (PPM), TECHNIQUES, REF:    .001, GC BNW,
90000
  (28) MAJOR HAZARDS:  LIFE HAZARD: POISONOUS BY INHALATION, INGESTION,
OR SKIN ABSORPTION. THRESHOLD LIMIT VALUE, 20 PARTS PER MILLION. MAC 20
PPM POISONOUS (TOXIC) WITH INGESTION OF LIQUID OR INHALATION OF VAPORS,
OR ABSORPTION THROUGH SKIN. POLYMERIZES IN PRESENCE OF PEROXIDES.
EXPLOSIVE MIXTURES WITH AIR. (3-17 V/O). HYDROLYSIS PRODUCT IS ACRYLIC
ACID.
  (29) STANDARD CODES:  NFPA: 4,3,2,P CFR - FLAMMABLE LIQUID, RED
LABEL, 10 GAL USCG - GRADE C FLAMMABLE LIQUID IATA - FLAMMABLE LIQUID,
RED LABEL, 1 LITER PASSENGER, 40 LITER CARGO.
  (30) MELTING POINT (DEG C):  -82.
  (32) BOILING POINT:  78.3
  (34) SOLUBILITY (PPM), 25 DEG C:  0070000.
  (36) SPECIFIC GRAVITY:  0.807
  (37) PROBABLE LOCATION AND STATE OF MATERIAL:  WILL BE DISSOLVED IN
WATER. COLORLESS LIQUID.
  (38) BINARY REACTANTS:  ACIDS (STRONG), POTASSIUM HYDROXIDE, SODIUM
HYDROXIDE, SULFURIC ACID
  (39) LOWER FLAMMABILITY LIMIT (%):  3.05
  (40) UPPER FLAMMABILITY LIMIT (%):  17.
  (41) TOXIC COMBUSTION PRODUCTS:  EXTREME DANGER, DO NOT ENTER
  (42) EXTINGUISHING METHOD:  FIRE FIGHTING PHASES: USE DRY CHEMICAL,
"ALCOHOL" FOAM, OR CARBON DIOXIDE. WEAR FULL PROTECTIVE CLOTHING.
  (43) LOWER EXPLOSIVE LIMIT(%):  3.05
  (44) UPPER EXPLOSIVE LIMIT (%):  17.
  (45) FLASH POINT (DEG C):  -1.
  (46) AUTO IGNITION POINT (DEG C):  481.
  (47) INHALATION LIMIT (VALUE):  0000045.
  (48) INHALATION LIMIT (TEXT):    (MG/M3)
  (51) DIRECT CONTACT:  LIQUID: MAY PRODUCE WELTS ON SKIN
  (52) GENERAL SENSATION:  MILD PUNGENT ODOR RESEMBLING PEACH SEED
KERNELS. WEAKNESS, LIGHT- HEADEDNESS, HEADACHE, NAUSEA, SNEEZING,
ABDOMINAL PAIN, VOMITING, ASPHYXIA AND DEATH. APPEARANCE OF IRRITATION
SYMPTOMS NECESSITATES IMMEDIATE EVACUATION.
  (53) LOW ODOR THRESHOLD (PPM):  000.0031
  (54) LOW ODOR THRESHOLD (TEXT):  , E-63
  (55) MEDIUM ODOR THRESHOLD (PPM):  000018.6
  (56) MEDIUM ODOR THRESHOLD (TEXT):  , E-63
  (57) UPPER ODOR THRESHOLD (PPM):  000050.4
  (58) UPPER ODOR THRESHOLD (TEXT):  , E-63
  (65) CORROSIVENESS:  NOT CORROSIVE TO METALS
  (68) DEGREE OF HAZARD TO PUBLIC HEALTH:  HIGHLY TOXIC AND FLAMMABLE.
EXTREME DANGER.
  (69) EXCHANGE CAPACITY WITH NATURAL SOILS:  DEGREE OF ADSORPTION ON
NATURAL SOILS SHOULD BE PROPORTIONALTO ORGANIC CONTENT AND SURFACE AREA
OF CLAYS. CYANIDE FORM-ED WILL NOT BE EXCHANGED WELL AS AN ANION.
  (70) INDUSTRIAL FOULING POTENTIAL:  LOW FLASH POINT SUGGESTS A REAL
EXPLOSION DANGER IF PRESENT IN BOILER OR COOLING WATER.
  (71) EFFECTS ON WATER TREATMENT PROCESS:  TOXIC TO ANAEROBIC
DIGESTION MECHANISMS
  (74) REC DRINKING WATER LIMITS (PPM):  000000.2
  (75) REF FOR REC DRINKING WATER LIMITS:    , C-11
  (78) FRESH WATER TOXICITY
  CONC.(PPM)/EXPOS.(HR)/SPECIE/EFFECT/TEST ENV/REF:
  100/24/ALL FISH/100% K/ /C-1
  24.5/24/PERCH/TLM/ /C-1
  30/24/PERCH/100% K/ /C-1
```

Figure 1. (continued).

```
   32.7/24/FATHEAD MINNOW/TLM/SAT OXYGEN 25 DEG.HARD/C-1
   16.7/48/FATHEAD MINNOW/TLM/SAT OXYG 25 DEG. HARD/C-1
   14.3/96/FATHEADMINNOW/TLM/SAT OXYG 25 DEG. HARD/C-1
   1350/24/FATHEAD MINNOW/TLM/SATOXYGEN 25 DEG. SOFT/C-1
   1300/48/FATHEAD MINNOW/TLM/SAT OXYGEN 25 DEG.SOFT/C-1
   1250/96/FATHEAD MINNOW/TLM/SAT OXYGEN 25 DEG. SOFT/C-1
   1250/24/BLUEGILL SUNFISH/TLM/SAT OXYGEN 25 DEG. SOFT/C-1
   815/48/BLUEGILLSUNFISH/TLM/SAT OXYGEN 25 DEG. SOFT/C-1
   720/96/BLUEGILL SUNFISH/TLM/SAT OXYGEN 25 DEG. SOFT/C-1
   1200/24/GUPPY/TLM/SAT OXYGEN 25 DEG.SOFT/C-1
   830/48/GUPPY/TLM/SAT OXYGEN 25 DEG. SOFT/C-1
   775/96/GUPPY/TLM/SAT OXYGEN 25 DEG. SOFT/C-1
   11.8/96/BLUEGILL/TLM/ /ADL
   33.5/96/GUPPY/TLM/ /ADL
   (80) SALT WATER TOXICITY
   CONC.(PPM)/EXPOS.(HR)/SPECIE/EFFECT/TEST ENV/REF:
   20/ SALTWATER FISH/DELETERIOUS/ /C-1
   .05-1/24/BLUEGILL/LETHAL/ /E-59
   10-33/48/SHRIMP/LC50/AERATED/E-88
   (81) ANIMAL TOXICITY
   SPECIE/LD50(MG/KG WT)/EXPOS.(HR)/REF:
   RAT/81/ /ADL
   MAMMALS/50-99/ /ADL
   G. PIG/368/DERMAL/E-221
   (86) AQUATIC PLANTS (PPM):  000005
   (87) REF FOR AQUATIC PLANTS:    , C-1 EXCEPT FUNGAL
   (90) MAJOR SPECIES THREATENED:  ALL SPECIES ARE THREATENED BY
POTENTIAL CYANIDE PRODUCTION.
   (91) ACUTE HAZARD LEVEL:  EXTREME
   (93) EMERGENCY WATER QUALITY STD (PPM):  0000100.
   (96) POTENTIAL FOR ACCUMULATION:  NONE
   (108) BOD5 (1LB/1LB)REF:
   25% THEO, 10 S, QUIESCENT C-10
   67% THEO, 10 RW,S, QUIESCENT C-10
   25% THEO, 10 AS, TREAT PLANT C-10
   70% THEO, 28 CA-N2, AS TREAT PLANT C-10 .7, 10 SEW SD, E-85
   (109) IN SITU AMERLIORATION:  RESPONDS WELL TO NITRILE ACCLIMATED
SEED. CAUSTIC WILL SUPPRESS HCN EVOLUTION AND HELP CONVERT IT TO LESS
TOXIC CYANATE. CARBON OR PEAT MAY BE USED TO ADSORB ACRYLONI- TRILE.
CAUSTIC MAY KILL ADDITIONAL FISH IN FREE WATERS, AND SHOULD BE USED
WITH CAUTION. BEST APPROACH IS TO LEAVE IN NITRILE FORM. CO2 IN AIR IS
ENOUGH TO RELEASE CN-. FERRIC SALTS CAN BE USED TO PRECIPITATE THESE
ANIONS.
   (110) BEACH SHORE RESTORATION:  DO NOT BURN OFF
   (111) AVAILABILITY OF COUNTER MEAS. MATERIALS:    CAUSTIC LIME -
CEMENT PLANTS CARBON - WATER TREATMENT PLANTS, SUGAR REFINERIES PEAT -
FLORAL SHOPS, NURSERIES FERRIC SALTS - WATER TREATMENT PLANTS,
PHOTOGRAPHY SHOPS
   (112) DISPOSAL METHODS:  SMALL QUANTITIES CAN BE POURED ON SAND AND
IGNITED. PROTECTIVE APPARATUS SHOULD BE WORN. CHLORINE SOLUTIONS WILL
CONVERT TO LESS TOXIC CYANATES. WATER WITH <50 PPM IS SUBJECT TO
BIOLOGICALDEGRADATION.
   (113) DISPOSAL NOTIFICATION:    AIR AND FIRE AUTHORITIES
   (114) CHRONIC HAZARD LEVEL:  RAT 1 MG/KG/DA/6 MO RABBIT 10 MG/KG/DA/6
MO NO KNOWN CHRONIC EFFECTS ON MAN.
   (115) FOOD CHAIN CON POTENTIAL:  NONE NOTED
   (116) PERSISTENCY:  BIODEGRADES AT MODERATE RATE. ACCLIMATION OF
BACTERIA INCREASES RATE OF DEGRADATION GREATLY.
   (117) MAJOR WATER USES THREATENED:  ALL WATER USES THREATENED BY
CYANIDE POTENTIAL
   (118) ADEQUACY OF DATA:  GOOD
   (120) MUTAGENICITY:  KNOWN TO REACT WITH T-RNA.
   (122) COLOR IN WATER:  COLORLESS
ENTER:
```

Figure 1. (continued).

provide advice on evacuation, initial response, safety problems, hazards, clean-up methods, disposal methods, first-aid, firefighting instructions and materials handling information.

Interagency Radiological Assistance Plan (IRAP). The Department of Energy sponsors this organization which is designed to help on-scene personnel in coping with a radiation emergency. Containment and disposal advice is given over the telephone, if the potential danger is minimal. When needed, a response team is dispatched to the scene (see Section VI for more details). IRAP is also accessed through CHEMTREC.

Lockheed Information Systems. Numerous information retrieval systems are available throughout the country. Table 5 presents a list of selected information retrieval systems, however, other sources are provided by universities or commercial organizations. Typical outputs include a list of pertinent articles and their associated abstracts which can be obtained through library service separate from or associated with retrieval systems. Lockheed Information Systems has the capability to search some 60 data files. It can be access by telephone up to 100 hours per week. The actual cost of each search depends upon the number of files examined and the number of off line printings. All resulting abstracts must be screened by technical personnel to identify the pertinent articles and obtain the necessary input data.

## Background Information Sources

Other important sources of information which are often used in determining a proper spill response can be considered background information sources. These can range from industrial safety manuals to basic chemistry textbooks. Background information sources may not address a hazardous material incident per se, but may still offer critical information regarding associated hazards, toxicology or general chemical behavior. This information can be applied to an On-Scene Coordinator (OSC) or technical advisor to plan safe, effective spill mitigation, or verify the approach being considered. Many different sources may be utilized. Those reviewed in this section were recommended by various spill response personnel, considered valuable by in-house personnel with treatment or response experience, or referenced by a complete response manual.

This review presents brief summaries of two types of background information sources. The first are basically toxicity oriented either from a medical or industrial viewpoint. The second set which are mostly directed to firefighters, are basically training texts written to provide necessary information to those first on the scene of an emergency spill incident. These references represent only a sampling of the materials available as background information for dealing with a spill situation. Many other texts are available which may be of use when responding to an emergency incident (see Table 7). It must be recognized that these references are not intended to be complete response manuals and cannot stand alone as major information sources. Instead they provide important back-up data to utilize in establishing the details of a response or checking a treatment approach. In most instances they do not address either mixtures or hazardous wastes in any detail.

The summaries present a brief description of the contents of the sources along with a presentation of various advantages and disadvantages regarding their usefulness in a spill incident and particularly their anticipated effectiveness when addressing a hazardous waste spill situation. More detailed or illustrative information pertaining to the referenced documents are included in Appendix A, pages A-8 to A-52.

Dangerous Properties of Industrial Materials (Fourth Edition) - Edited by N. Irving Sax (6). The purpose of this manual is to provide a single source for concise hazard analysis information on nearly 13,000 common industrial and laboratory materials. Descriptive and technical information is given in the various sections of the book. One section, comprising the main body of the reference, is devoted to general chemicals. A cross-reference approach is used which requires that the reader be familiar with the text of the previous sections in order to use the section on general chemicals effectively. Since the manual is so thorough in its discussion of industrial materials, it is not easy to use.

The section on general chemicals was designed to expedite retrieval of hazard information by categorizing the data into:

1. General information: synonyms, description, formula and physical constants.
2. Hazard analyses: toxicity, fire hazard, explosion hazard.
3. Counter measures: handling, storage, shipping information, first aid, firefighting instructions and personnel protection.

However, the information does not have much repetition of form and locating the relevant information by cross referencing may be difficult. Indexing is not provided so locating an entry from its synonym is difficult. An example of a typical entry is presented in Appendix A, page A-8.

There is a wide variety of information included which has been provided by experts in their respective fields. It offers good information on specific topics including radiological, air contaminant, microwave, laser and ultraviolet radiation hazards. The general chemicals section is difficult to use and does not provide a large amount of pertinent information for spill response, first aid and health protection. Handling methods are not discussed directly. A Table of Contents is included in the Appendix, p. A-9.

The manual is not intended for use by emergency personnel. The reference can be useful to verify hazards associated with the emergency when used by technical people.

A summary of pertinent advantages includes:

1. The manual addresses a wide variety of hazardous chemicals individually. Some may be pertinent to hazardous waste situations when the identity of the material is known.
2. Mixtures are listed although not in detail.
3. Human health protection information (human toxicity, flammability, explosion and disaster hazard) is included in the source.
4. Labeling and placards are discussed but not specific to each material.

5. The data source is readily accessible and available to the general public.

Disadvantages associated with the manual are:

1. The information is hard to locate because of extensive cross referencing and lack of a comprehensive index. Therefore, the reference is difficult to use.
2. Environmental protection information is not presented.
3. The impacts of hazardous material spills are not presented.
4. Identification, assessment, control and disposal of hazardous material spills are not discussed.
5. Notification procedures and initial response information is not included.

MERCK Index (ninth Edition) - Edited by Martha Windholz (7). The MERCK Index is a comprehensive, inter-disciplinary encyclopedia of chemicals, drugs, and biological substances. The MERCK Index is basically a dictionary for chemicals. Each of the 9,856 chemicals is described in a structured format. Organic reactions are explained and miscellaneous tables are given. An extensive index and cross-index has been compiled, so the reference is quite easy to use. The Table of Contents, a typical entry and enclosed explanatory notes are included in Appendix A pages A-10 - A-15.

The MERCK Index does not address hazardous waste spills and it only discusses pure substances. Toxicity and general hazards are presented, but the book is mainly used as a chemists' desk reference and is of little direct value to those concerned with the spills of hazardous wastes. It does, however, serve as an excellent reference source for general information on toxic and hazardous chemicals and is readily available to most chemists. The major advantages are summarized as follows:

1. The manual addresses 9,856 chemicals individually. The information presented is pertinent to hazardous waste situations where the identity of the material is known.
2. The MERCK Index is easy to use because it includes a comprehensive index and references chemicals in a systematic manner.
3. Human health protection information is included with data on toxicity, dermal toxicity, and antidotes.
4. The data source is readily accessible and available to the general public.

Major disadvantages are:

1. Mixtures of pure materials and mixtures of hazardous wastes are not addressed in this source.
2. Identification, assessment, control and disposal of hazardous spills are not considered.
3. Environmental protection and impacts are not presented.
4. Notification procedures, legal requirements, labeling, placarding and first response information is not included.

Toxic and Hazardous Industrial Chemicals Safety Manual - The International Technical Information Institute (8). This manual covers 702 toxic and hazardous chemicals. It provides practical data and accurate information on chemicals which are used in Japan. The chemical names are listed in alphabetical order and there is an index which includes both chemical names and synonyms.

Each chemical is assigned an index number. There are ten items included in the manual for each chemical. These items are as follows: 1) chemical name and synonyms, 2) constitutional or rational formula, 3) uses, 4) properties, 5) criteria for hazard, 6) criteria for toxicity, 7) handling and storage, 8) emergency treatments and measures, 9) spills and leakage, and 10), disposal and waste treatment. A detailed listing and example are included in Appendix A pages A-16 and A-17.

The manual is intended to be a desk reference for those involved with the handling and disposal of hazardous industrial chemicals. The items discussed vary in their level of specificity. For example, chemical properties are written so that they contain enough technical data to be of use to a chemist. The discussion of handling and storage of the chemicals is written so that it could be understood by a warehouseman or a trucker. The information on toxicity is fairly specific. A brief but useful discussion is given to disposal and waste treatment. In general, when background information for specific material is required, this reference source is useful. It is relatively easy to use and understand and, therefore, it is more useful and complete than other texts of its type.
The main advantages of this manual are:

1. The manual addresses 702 chemicals individually. When the identity of a hazardous waste is known, the information presented may be pertinent to spill situations.
2. The source is easy to use since the chemicals are listed in alphabetical order with a consistent format and a complete index.
3. Human health information is presented, including flammability, explosive hazard and toxicity.
4. First aid and safety procedures are included.
5. Mitigation procedures, disposal and waste treatment techniques are discussed. However, details are not provided.
6. Initial response information is presented.

Disadvantages include:

1. Mixtures are not addressed
2. Identification and assessment of hazardous spills are not considered.
3. Environmental impacts are not discussed.
4. Control of waste spills is not considered.
5. Notification procedures, legal requirements, labeling and placarding information is not included.

Chemical Safety Data Sheet - Manufacturing Chemists Association (MCA) or chemical manufacturer (9). These comprehensive background data sheets have been prepared by the manufacturer for use by their customers. The information can be used as back-up data to verify other evaluations. Up-to-date information regarding grades, properties and characteristics, health hazards, engineering control of hazards, firefighting methods, techniques for handling and storage and first aid are presented. They are relatively lengthy and are very specific to chemical type. The information is complete but requires that the user have a significant amount of background knowledge on the subject. The data sheets provide a significant amount of information although very little is directly applicable to hazardous waste spills. An example is included in Appendix A, pages 49 and 50.

Advantages include the following:

1. The sheets are easy to use since they provide detailed data in a consistent manner,
2. Human health information is presented including toxicity, flammability and explosion hazard data.
3. First aid, safety, handling and storage procedures are included.
4. Labeling information is briefly discussed.

Disadvantages are:

1. Identification, assessment, control and disposal of hazardous spills are not discussed.
2. Mixtures are not addressed and overall applicability to hazardous wastes is minimal.
3. Environmental protection and impacts are not presented.
4. Notification and general legal requirements are not presented.

Chemistry of Hazardous Materials - Eugene Meyer (10). This text was written to serve as a tool for introducing a firefighter to the basic concepts of chemistry. Specific compounds are rarely addressed but rather classes of materials are covered. The general dangers associated with each class of materials are stressed.

The text opens with a discussion on matter and energy. Physical properties such as heat capacity, phase changes, volume expansion, and vapor pressures are introduced. A basic understanding of these phenomena will make later discussions more meaningful.

The chemistry of some common elements, corrosive materials, water reactive materials, toxic materials, chemical explosives, organic compounds, and even radioactive materials are presented. Some appropriate subtopics include combustion and methods to extinguish fires. Safety is stressed in all categories.

Additional information is included on the DOT placard system, as well as the 704M identification system established by the National Fire Protection Association. First aid procedures for poisoning are included. General measures to combat poisoning are tabulated, if the cause is unknown. Specific symptoms and treatments are listed for commonly encountered substances. The Table of Contents is included in Appendix A page 18 for reference. The text is a good training tool, but not directly applicable for reference in a

spill situation. It stresses understanding as the best way to handle these emergencies safely. A study of this text by the response personnel will increase the usefulness of other texts that are concerned in detail with specific hazardous materials and wastes.
The major advantage are as follows:

1. The text is easy to understand and does not require the reader to have extensive background information.
2. The information included may be applicable to hazardous wastes if the identity of this material is known.
3. Safety procedures are included and stressed.
4. Human health affects are addressed on a very general basis but with a good background discussion.
5. Initial response techniques are presented.

Major disadvantages include:

1. Mixtures are not addressed and applicability to hazardous waste spills is minimal.
2. Access to information on specific materials can be difficult.
3. Identification, assessment, control and disposal of hazardous spills are not discussed.
4. Environmental protection and impacts are not presented.
5. Notification and general legal requirements are not included.

First Officer's Guide to Dangerous Chemicals - Charles W. Bahme (11). This text is written to give firefighters an overview of the problems associated with chemical fires. It does not attempt to address each of the individual chemicals, instead it groups them into eleven different categories as shown in the Table of Contents (See Appendix A page 21). It is stated in the preface that the guide presents dangerous chemicals from the standpoint of "what they are, where they are likely to be encountered, and how they are likely to react in an emergency situation and what you can do about it when called to the scene".

The introductory chapter briefly highlights certain important aspects of firefighting response which are generally applicable to all chemical types. It is suggested that the firefighter have a list of pertinent contacts with outside information and, if possible know where dangerous chemicals are used in the district. Identification information is general but informative. A firefighter is cautioned against using generalized DOT placards as positive identification because of potential problems with incomplete or inaccurate labeling. The NFPA 704M system of labels is recommended as more applicable. The information on the bill of lading or train waybill is discussed but is not considered to be helpful because of the difficulty in obtaining access to it. It is stressed that in all cases, the incident should be handled as very hazardous until positively identified. Some general information on handling leaks and spills is included. Several NFPA references are recommended, as well as MCA's Safety Data Sheets and CHEMTREC. There is a general discussion of spill handling with respect to leaks, spills or fires. At all times, safety of the firefighters is emphasized.
The information included in most of the chapters includes:

1. A brief description of chemicals.
2. Likely locations by industry type.
3. How the materials react in a fire.
4. How to fight the fires.
5. What are the associated hazards in a fire situation.

Where possible, examples are included to highlight the problems.

In general, the guide presents important information to a firefighter who is first on the scene. It should allow safe initial actions if the fire official is familiar with the contents and general recommendations prior to reaching a spill incident. The general organization is not designed to allow quick field reference and instead recommends other sources for this information.
Major advantages include:

1. Safety procedures are discussed and emphasized throughout the handbook.
2. It is easy to understand and does not require extensive background information.
3. Identification procedures and potential problems with identification are addressed.
4. Initial response, safety and first aid are presented on a general basis.

Disadvantages are:

1. Mixtures are not addressed and the guide's overall applicability to hazardous wastes is limited.
2. Assessment, control (after initial response) and disposal of hazardous spills are not discussed.
3. Environmental protection and impact information are not included.
4. Notification and general legal requirements are not presented.
5. Human health protection information is not extensive or presented in detail.

Hazardous Materials - Leroy Schieles and Denis Pauze (12). This text has been written to provide an overview of problems associated with hazardous material handling. Basically, it is addressed to firefighters since both authors have been involved with teaching hazardous chemicals courses. The chemicals are grouped into 22 categories and the book includes 37 units, many of which are explanations of chemical phenomenon. A Table of Contents presenting all of the divisions is included in Appendix A page 22.

The beginning section on basic sciences is designed to introduce some basic chemical concepts which explain the problems associated with hazardous chemicals. Then specific chemical groups are addressed. The information presented includes:

1. Where hazardous substances are used.
2. Degree of hazard.

3. Physical and chemical properties.
4. Storage facilities.
5. Transportation methods.
6. Precautionary measures and emergency and firefighting procedures.

The categories are more specific than in most other sources, so the information is more detailed. The book includes a description of current (1976) DOT placards plus information on the proposed hazard index system. Some additional manuals are also referenced.

The information presented in this text is very helpful to a firefighter first on the scene. Prior knowledge of the details is necessary but the method of presentation is quite simple and straightforward. The text is not designed to offer complete response techniques but it does include valuable information on the initial emergency techniques and associated safety procedures. The summary tables are very useful.

Advantages include:

1. The text is clearly written and easy to understand. It does not require extensive background information prior to application.
2. Safety procedures are stressed especially with regard to spill containment and initial response to emergencies.
3. Placards, labeling and some legal requirements are discussed in general.
4. First aid, safety and safe handling techniques are presented.
5. Identification and some spill clean-up procedures are mentioned.

Disadvantages are:

1. Mixtures are not addressed and the overall applicability to hazardous wastes is minimal.
2. Assessment, control and disposal of hazardous spills are not discussed in detail.
3. Environmental protection and impacts are not presented.
4. Access to specific information is difficult due to the type of categorization.
5. Notification requirements are not included.

## Immediate Response Manuals

Certain manuals have been prepared which address the problems associated with initial response to a spill incident. In these manuals protection from hazards to human health is paramount. The purpose is to minimize the hazard without endangering more people. Identification techniques, potential hazards, evacuation procedures, notification techniques and sources of additional information are generally considered. The information is usually presented to be understood by uninitiated personnel who may be first on the scene or by firefighters who may have some background training. The manuals reviewed here present a general overview of sources which address the problems associated with initial response. They have been written to meet different objectives so should not be considered equivalent in all aspects. The one factor they have in common is that all address actions during the initial response to a spill situation.

Emergency Handling of Hazardous Materials in Surface Transportation - Bureau of Explosives, Association of American Railroads (13). This paper covered text actually contains four pamphlets entitled:

B. E. Pamphlet No. 1: Recommended practice for handling incidents involving hazardous materials.

B. E. Pamphlet No. 2: Recommended practice for handling fires and spills of hazardous materials. Commodity information.

B. E. Pamphlet No. 3: Special energy research and development administrative shipments. Radioactive materials.

B. E. Pamphlet No. 4: Recommended procedures to stop leaks in dome fitting housing of liquified petroleum gas tank cars.

The information is basically directed to containment of any transportation accident and the minimization of dangers associated with it. It is recommended that the users be familiar with the contents of pamphlets 1, 2 and 4 prior to a potential emergency. Additional information can be obtained from CHEMTREC and the Bureau of Explosives' local and federal inspectors.

The Pamphlet No. 1 addresses problems associated with railroad tank cars in particular. Among the hazardous chemical classes considered are: flammable gas and flammable liquid, poison gas, nonflammable gas, corrosive material, oxidizer, poison B, flammable solids, explosives, compressed gases, irritants and radioactive materials. Some brief immediate action information is presented. Among the information included are safety procedures, ventilation requirements, brief firefighting instructions and a general mention of associated hazards. A list of emergency contacts with telephone numbers is also presented.

Pamphlet No. 2 presents detailed information on approximately 2,000 chemicals. A typical page is shown in Appendix A page 23. One of the more interesting aspects is that some types of waste products are mentioned and that a specified hazard code number is assigned to each material.

Detailed instructions for radioactive material emergencies are included in Pamphlet No. 3. Instructions regarding containment are presented in detail for different package types and for special transportation vehicles. Energy Research and Development Administration (ERDA) office telephone numbers are included for contact in the event of an emergency involving radioactive materials or wastes.

Pamphlet 4 deals with stopping leaks in liquid petroleum gas tank cars. A warning in the text indicates that the recommended procedures presented are suggested only and do not guarantee safe response. Very detailed information is presented with the critical instructions highlighted in bold type. The book also contains color illustrations of the required DOT placards and labels although no explanation is included.

In general, the guide presents much useful information. It can be easily used by a transporter or local authority if some initial training has been undertaken. The organization is good and most information is easily accessed. Prior knowledge of the abbreviations and key phrases utilized in the instructions would be beneficial. The basic content is limited to initial response with no emphasis on total clean-up and disposal.
The advantages of this manual include:

1. The reference addresses a wide variety of hazardous chemicals individually as well as some wastes. When the chemical identity of the waste stream is known, the information may be pertinent to hazardous wastes.
2. The manual is quite easy to use and access since most materials are addressed alphabetically in a similar format.
3. Human health protection is considered in a general section which discusses overall hazards but specific numerical values are not given.
4. Safety and first aid procedures are included.
5. Initial response information is addressed with respect to placard types and individual chemicals.

Disadvantages are:

1. Detailed information on identification, assessment, control and disposal for hazardous spills is not included.
2. Lack of material identification precludes access to information in the manual.
3. Environmental protection and impact information is presented only very briefly.
4. Mixtures are usually not addressed.
5. Notification requirements and legal restrictions are not included.

Guidelines to the Handling of Hazardous Materials - Darrel J. Behrendsen (14). The guidelines are to be used as a quick and handy reference tool by emergency personnel and/or shippers and carriers of hazardous materials. The manual has the same dimensions as a roadmap and, therefore, can be easily carried by those who transport hazardous materials. Fifteen classes of hazardous materials are defined and classified. The manual is meant to assist in the identification of hazardous materials by proper DOT labels and can serve as a guide for emergency personnel or others to protect themselves and the general public against hazardous chemicals. An Index (Table of Contents) is included in Appendix A page A-26 and includes the listing of classifications.

A hazardous materials table is included listing seven items:

1. Regulation by air or water.
2. Proper shipping names.
3. Hazard class.
4. Lables required.
5. Packaging.
6. Package capacity.
7. Water shipment instructions.

A sample listing and its general explanation is also included in Appendix A, page 25.

This manual is quite convenient but does not present a broad scope of information by chemical. Instead information is classified according to placard type. This simplified approach does make the manual easy to use but does not present as much information as might be needed by the user.

The manual does address hazardous wastes since these materials can be classified into the various placard groupings.

Major advantages to this manual are:

1. The manual is easy to use since it is accessed by DOT placard type or through the identity of the material.
2. Definitions and classifications of DOT hazardous materials are discussed.
3. Hazardous wastes are included if they are classified by a DOT placard type. They are not addressed directly.
4. Initial response information is presented with regard to spillage and fire. First aid procedures are also included.
5. Brief descriptions of clean-up and disposal are presented.
6. Preliminary identification techniques are presented.
7. Notification requirements and legal restrictions are briefly discussed.

Disadvantages include:

1. Detailed assessment, control and disposal procedures are not presented. Specific information regarding spill response by chemical type is not included at all.
2. Mixtures are not addressed separately. Wastes are considered only on a broad sense.
3. Human health hazards are not addressed.
4. Environmental protection information and impacts are not considered.

Hazardous Materials Handbook - James H. Meidl (15). This manual is designed to serve as a quick reference in reacquainting emergency personnel with the dangers associated with over 1,500 chemical materials. The manual is small enough, physically, to be easily carried into a spill area.

The majority of the book consists of an alphabetical listing of chemicals. An example of a typical page is shown in Appendix A page 28. The NFPA 704M ID and DOT classification are included, as well as a brief description of explosive hazards. Firefighting procedures are presented briefly by a cross-index approach using codes. This approach permits the listing to be condensed, yet relatively thorough. When additional information for a chemical is necessary, it is included in the listing in italicized print.

Although the manual does not address spill situations directly, it nonetheless, would be of value to have on the scene of an accident. One of the main advantages of this manual is that it attempts to alert the user to the dangers of exposing a chemical material to heat or other substances in the Mixture Hazards Category. For each material listed, specific substances which could cause an explosion, dangerous gas evolution or other such hazards upon contact are mentioned. The manual was intended for use by firefighters. It centers on the dangers to the responding personnel and bystanders. It points out some of the immediate problems but does not discuss necessary corrective measures. It is quite easy to use and provides a significant amount of information in a small space.
The advantages of this manual include:

1. The manual is quite easy to use. The chemicals are presented in alphabetical order and are in a tabular format.

2. The reference addresses a large number of chemicals individually. It is applicable to hazardous wastes when the identity of the material is known.
3. Initial response information is presented with regard to spillage and fire. Some toxicity data is included.
4. Mixtures and the potential safety problems associated with mixtures are considered for each chemical.

Disadvantages are:

1. Unidentified mixtures of hazardous wastes are not addressed.
2. Detailed identification, assessment, control and disposal of hazardous spills are not presented.
3. Environmental protection information and impacts are not considered.
4. Notification requirements and legal restrictions are not addressed.

Hazardous Materials Safety Manual - State of Minnesota, Department of Public Safety, Division of Emergency Services (16). This manual is a brief, easy to use pamphlet which discusses 15 classes of hazardous materials, shipping papers, DOT placards, notification list and notification information. For each hazardous material classification the following criteria are discussed:

1. Definition.
2. Potential hazards.
3. Immediate action.
4. Immediate follow-up action.
5. Spill or leak.
6. First-aid.

The purpose of this manual is to aid those confronted with a hazardous material accident. The manual serves as a concise and easy to use document which gives information on 15 classes of hazardous materials identified by placards or labels. The Table of Contents listing the classifications and a sample entry are presented in Appendix A; page 29.

The manual is written to aid those emergency personnel who arrive at the accident scene. It presents good general information on identification and first response by material class. However, neither detailed response information by chemical compound nor the environmental aspects of spill response are included.

Advantages of this manual include:

1. The manual is easy to use. All classifications are presented in a consistent format keyed to the DOT placard classifications.
2. The importance of identification and notification are stressed. Preliminary procedures for material identification are presented.
3. The information is applicable to hazardous wastes placarded according to DOT regulations.
4. Important first response information including fire fighting procedures, leak stopping methods and general spill response are briefly discussed.
5. The guide does not require extensive background information for effective use.

Disadvantages are:

1. Detailed identification, assessment, control and disposal procedures for hazardous spills are not presented.
2. Human health hazard information is not included.
3. Unidentified or non marked mixtures or pure materials, including hazardous wastes, are not addressed.
4. Environmental protection information and impacts are not considered.

*National Fire Codes, Volume 3: Combustible Solids, Dusts & Explosives-National Fire Protection Association (NFPA) (17)*. This is one of ten volumes of the National Fire Codes published annually by the National Fire Protection Association (NFPA). This volume contains a selected group of the NFPA codes and standards pertaining to the storage, handling and use of combustible solids, dusts and explosives. In addition there is an extensive section which presents hazard chemical data information. A Table of Contents is presented in Appendix A page 32.

The various substances in the codes are addressed in different ways. Normally, a brief description is given of manufacturing, transportation and storage practices for the different combustible substances. Requirements and recommendations are then given for handling these materials. The NFPA assigns committees to discuss the various substances, as a result certain substances are discussed in greater detail than others. References are given for some sections.

The hazardous chemical data section presents information on chemicals considered reactive or hazardous by NFPA. The list is continually being updated as more information is compiled. The data presented includes:

1. Description of material
2. Usual shipping containers
3. Storage procedures.
4. Fire fighting phases
5. Fire and explosion hazard
6. Life hazard
7. Personal protection
8. Remarks

A typical entry is included in Appendix A, page 34. The assigned NFPA identification label is also displayed and discussed.

The highly visible diamond-shaped diagrams are specific to chemical type and enable the firefighter to quickly have a general idea of the inherent hazards of the chemical and the order of severity of these hazards . (See Figure 2 for an example).

The diagram identifies: 1) health, 2) flammability, and 3) reactivity on a grading system (4 being the most hazardous and 0 denoting no special hazard), as well as whether or not to use water in the emergency situation. These diagrams give on-the-spot information to safeguard the lives of fire-fighting personnel and the others who may be exposed.

The information is most applicable to those personnel who must respond to an emergency or who are responsible for safe handling of hazardous chemicals. Previous knowledge of the contents would make the application of the presented information more feasible in an emergency situation.

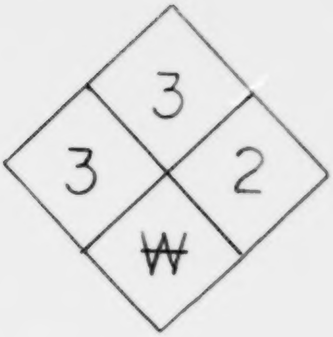


Figure 2. Sample of NFPA label for acetyl chloride.

Advantages include:

1. The codes address a wide variety of hazardous chemicals individually. The information may be pertinent to hazardous waste spills when the identity of the material is known.
2. Human health protection is addressed with data regarding fire and explosion hazards and potential toxicity.
3. The manual, especially the hazardous chemical data sheets, is quite easy to use, although previous familiarity with the contents is desirable.
4. Initial response information with respect to fire fighting is presented for many chemicals.
5. First aid and safety procedures are stressed.

Disadvantages are:

1. The manual has only limited applicability to hazardous waste spills. Mixtures are not addressed at all.
2. Identification, assessment, control and disposal procedures for hazardous spills are not addressed.
3. Notification requirements and legal restrictions are not considered.
4. Other types of placards and labeling are not discussed.
5. Environmental protection information and impacts are not included.

Hazardous Materials - Emergency Action Guide - US Department of Transportation (18). This guide was developed to help emergency response personnel during the first thirty minutes after an incident occurs. Forty-three hazardous chemicals, which are most commonly shipped in bulk, are addressed. Both general and specific safety procedures are included.

Typical entries are presented in Appendix A, page 36.

The information presented includes: Potential hazards (fire, explosion or health), immediate action to take, immediate follow-up action to take (fires, spill or leak, first aid): additional follow-up action. The most detail is given with regard to potential hazards and evacuation. Distances for safe evacuation are included both for explosive dangers and vapor exposure, which is unusual in a spill manual. Wind velocity is considered when determining the affected area. Immediate follow-up actions are also presented in some detail. Directions are clear and concise with highlights in red or heavy print.

This guide is a helpful aid to those first at an accident scene. The information is presented clearly and concisely so it can be readily applied by uninitiated personnel. Additional training may make the application more complete but is not mandatory for its use. The guide meets its objective by presenting critical input to those responding to a spill incident during the first thirty minutes.

The advantages include:

1. The guide is easy to use and understand. Information is presented clearly and consistently for the chemicals addressed. Little previous knowledge is required.
2. Critical first response information is presented clearly and concisely. It includes fire fighting, leak stopping and first aid procedures.
3. Human health hazards are discussed with information regarding fire, explosion and health hazards.
4. Notification is directed and other information sources are referenced.
5. Environmental protection with respect to water pollution is addressed briefly.

Disadvantages are:

1. Specific information is limited to 43 individual chemicals, so applicability to hazardous waste spills is extremely limited.
2. Identification, assessment and disposal procedures for hazardous spills are not addresssed at all. Control techniques are presented only briefly.
3. Placards and labels are not included.
4. General environmental impacts and protection are not addressed.

Handling Hazardous Materials Transportation Emergencies - A Training Course for Emergency Services - NFPA (19). A training course has been developed for the purpose of acquainting emergency personnel with proper response techniques for dealing with a hazardous materials emergency. The course has been split into eight units requiring approximately 20 hours of instruction.

The stated goal of the course is "to enable emergency service personnel to deal effectively with a hazardous material emergency involving highway, rail and terminal operations, and the marine and air modes".

Overall objectives are stated as follows:

1. To provide emergency service personnel with an awareness of the hazards involved in dealing with identified and unidentified hazardous materials.
2. To enable emergency service personnel to more effectively evaluate the hazards involved in a transportation incident involving hazardous materials and make more informed judgments related to implementing proper actions.
3. To enable the participants to view their communities in terms of a system which involves risks at several entry points.
4. To encourage communities to develop contingency plans to organize themselves and to be prepared for a hazardous material incident.
5. To provide accessible and easily understood methods for determining planning strategies.
6. To provide participants the opportunity to seek a better understanding of the operating procedures, personnel and equipment used by the highway and rail modes of transportation.
7. To enable the participants to discover gaps in existing knowledge before incidents occur rather than during the performance of emergency procedures.
8. To encourage the participants to seek additional knowledge and training for dealing with hazardous materials emergencies.

The coursework generally includes a general presentation and various worksheets to be completed by the trainees. Among the topics covered are the chemistry of the various materials, pertinent regulations, common chemical uses, identification procedures and outside information sources. Simulated spill incidents are also included in the units.

This training manual appears to meet its objective of preparing initial response personnel to handle emergency incidents. However, it requires extensive use of outside sources of data for detailed information regarding hazards and clean-up.

Advantages of this course are:

1. It addresses, in detail, critical information with respect to initial response to hazardous spills.
2. Specific information on identification is presented.
3. Safety in first response is stressed.
4. Regulations, placarding and labeling are explained.

Disadvantages are:

1. The training course does not present specific information by chemical or placard type and therefore does not provide direct first response information. It is only applicable to hazardous waste in a general sense.
2. Assessment, control and disposal procedures for any hazardous spills are not covered.
3. Environmental impact and environmental protection information are not discussed.

4. Human health information, by chemical, is not included. Only potential general hazards are discussed.
5. Notification requirements are not included.

CHEM-Cards Cargo Information Cards - Manufacturing Chemists Association (MCA) (20). Individual cards have been developed by the Manufacturing Chemists Association (MCA) for 86 different pure chemicals. These provide basic first response information to those transporting a spill or first at the scene of the incident. The cards contain the following information:

1. A brief physical description of the chemical.
2. A summary of fire and exposure hazards.
3. Guidelines for fire, spill, leak or exposure situations.
4. The CHEMTREC phone number.

The cards are clearly written and present the information in a simplified format. Cards are to be sent with the specific cargo and can be obtained from the Manufacturing Chemists Association. An example is included in Appendix A, pages 49 and 50.

Advantages include:

1. The cards are easy to use and understand. Information is presented clearly and consistently for the chemicals addressed. Little previous knowledge is required.
2. Critical first response information is presented clearly and concisely. It includes fire fighting, leak stopping and first aid procedures.
3. Health hazards are discussed.

Disadvantages are:

1. Specific information is limited to 86 chemicals. Mixtures and identification procedures are not addressed so that applicability to hazardous waste spills is minimal.
2. Containment, assessment, control and disposal procedures for hazardous spills are not addressed.
3. Placards and labels are not included.
4. Environmental impacts and protection are not considered.

Fire Protection Guide on Hazardous Materials - National Fire Protection Association (NFPA) (21). The NFPA has combined five manuals into one comprehensive guide regarding hazardous materials. The five parts include:

1. Flash Point Index of Trade Names - This lists more than 8800 trade name chemicals, their flashpoint manufacturer, and principal uses. The flammability hazard can be inferred from this information. A typical entry is included in Appendix A page 51.
2. Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids. Thirteen hundred flammable materials are listed in alphabetical order with appropriate fire fighting information. Various

properties including flashpoint, specific gravity, water solubility, hazard identification and boilg point are included. A typical entry is shown in Appendix A, page 52.

3. Hazardous Chemicals Data - Data on 416 chemicals is presented. (See previous section on National Fire Codes - Volume 3 for more details).
4. Manual of Hazardous Chemical Reactions - over 3550 mixtures of chemicals are included. These may involve two or more chemicals which could cause fires, explosions or other problems. The initial chemical is listed followed by identification of chemicals which can cause a hazardous reaction.
5. Recommended System for the Identification of the Fire Hazards of Materials - The NFPA labeling system is described in detail, with careful explanations of the rating meanings.

This Guide presents a large amount of information but it is limited to application with pure chemicals. Identification of mixtures is not included. Users of the guide should have previous experience with the manual since the information does require interpretation.

Advantages include:

1. A wide variety of chemicals are addressed and some information on mixtures is included. The data may be pertinent to hazardous waste spills when the identity of the material is known.
2. Human health protection is addressed with data regarding fire and explosion hazards, mixture problems, temperature effects and potential toxicity.
3. First aid, safety procedures and labeling systems are discussed.
4. Manufacturers' identities are presented.

Disadvantages are:

1. The manual has limited applicability to unidentified hazardous wastes.
2. Previous familiarity with the contents is necessary for effective use of the information.
3. Identification, assessment, control and disposal procedures for hazardous spills are not addressed.
4. Notification requirements, legal restrictions and other labels are not considered.
5. Environmental protection information and impacts are not included.

Transportation Emergency Card (Tremcards) - Redland Purle (22). Redland Purle, a British firm, has developed various cards which present emergency procedures to follow when hazardous wastes are spilled. The following classifications are included:

1. Acid sludge/solid in bulk.
2. Acid liquid in bulk.
3. Alkali liquid in bulk.

4. Alkali sludge/solid in bulk.
5. Process waste sludge/solid.
6. Bulk organic liquids - flash point > 21°C.
7. Bulk organic liquids - flash point < 21°C.
8. Bulk organic solids/sludge.
9. Contaminated material.
10. Sodium cyanide.
11. Cyanide solution.
12. Non hazardous.
13. Miscellaneous inorganic-organic chemicals (containers less than 10 gallons).

These Tremcards identify the hazards and some types of remedial actions to be taken if one of these materials is released accidentally. The format is simple and easy to understand. Most of the information is addressed to an initial response and an example is included in Appendix A; page 38.

Each Tremcard discusses the specific cargo, the nature of its hazard, protective devices, emergency action, spillage, firefighting instructions and first aid. Space is given for Redland Purle's telephone number, though it was not listed. Toxicity and identification procedures were not discussed.

This information was the only source which dealt directly with hazardous waste. It is simple to use and generally applicable to a wide range of situations. However, the information is not presented in sufficient detail to allow a complete response.
Major advantages include:

1. Hazardous waste mixtures are directly addressed in this source.
2. These cards are easy to use. Major information is highlighted and presented in a consistent format for all classifications. No prior training is needed.
3. The general hazards are presented along with first aid information.
4. Initial response information is presented clearly and concisely including fire fighting and leak stopping procedures.

Disadvantages include:

1. Detailed information regarding identification, assessment, control and disposal of hazardous spills is not included.
2. Notification procedures and legal requirements are not addressed.
3. Environmental impacts are not discussed.
4. The cards are limited to a small number of categories.

## Complete Response Manuals

Some manuals have been developed which address or attempt to address complete response to a spill incident. The EPA's Oil and Hazardous Materials - Technical Assistance Data System (OHM-TADS) was included in this category. Each of the response manuals addresses the problem a differently.

U. S. Coast Guard - Chemical Hazard Response Information System (CHRIS) (23). A major part of this system is the CHRIS Manual. This manual is divided into four volumes which present different types of information needed for spill response. The entire set is directed to spill response on large water bodies under the Coast Guard jurisdiction.

Volume 2-CG-446-1 - Condensed Guide to Chemical Hazards - contains essential information on those hazardous chemicals that are shipped in large volumes by marine transportation.

Volume 2-CG-446-2 - Hazardous Chemical Data Manual - contains detailed information on the chemical, physical and toxicological properties of hazardous chemicals, in addition to all the information in Volume 1.

Volume 3-CG-446-3 - Hazard Assessment Handbook - contains methods of estimating the rate and quantity of hazardous chemicals that may be released and methods for predicting the potential toxic, fire and explosive hazards. Dispersion in water and air is predicted.

Volume 4-CG-446-4 - Response Methods Handbook - contains information on existing methodology for handling spills in large water bodies. The Appendix to this volume contains a list of manufacturers of equipment which may be useful in a spill situation.

Other tools involved in CHRIS include the regional contingency plan, a Hazard-Assessment Computer System (HACS) which is a computerized counterpart to Volume 3 and response personnel located at selected Coast Guard stations.

The various volumes present different information and address different audiences. The four volumes are described below.

Volume 1 is intended for use by those first on the scene of a spill. The identity of the chemical must be known, however, before the appropriate information from the manual can be obtained. A typical page is shown in Appendix A; page 39. This volume also contains a list of the questions needed to access Volume 3, the Hazard-Assessment Handbook.

Volume 2 which presents a comprehensive summary of hazardous chemical data is the basis for much of the CHRIS system. This and subsequent volumes are intended for use by trained personnel at a spill site. A typical data sheet is also included in Appendix A. Hazard assessment and response mode codes have been developed to allow cross reference to Volume 3 and 4. These codes reduce the amount of repetition required between volumes.

Volume 3 presents methods for calculating the potential dangers associated with a spill event. Input information has been categorized into two types - primary which is mandatory for any assessment, and secondary which is desirable for obtaining detailed outputs. Primary information includes name of the material spilled, when, where, and how much was discharged, plus some weather and stream current conditions. Secondary information involves estimates of rate of release, water depth and temperature, physical conditions associated with the spilled material and the accident. The handbook presents information regarding evacuation area, plume distance, explosion potential, water pollution hazards, etc. In order to obtain the needed input information, detailed descriptions of sources or methods are included. Then various calculation steps are presented. Figures are included whenever possible to reduce associated calculations.

Volume 4 presents response methods for use in containment and some mitigation of spills (primarily oil or floating chemicals). The amount of instruction detail varies with the type of treatment being considered. It is, however, intended for use by personnel who have some previous training in hazardous spill control. The response techniques are limited to control of spills into large water bodies and have not been developed for individual chemical types.

In summary, CHRIS is an extensive manual developed for use by the U.S. Coast Guard and others in controlling hazardous spills. It presents a tremendous amount of information regarding the listed CHRIS chemicals and is valuable to a broad range in audience background. The assessment section provides a logical approach to establishing hazard zones but may require excessive response times. The response methods are not presented in detail and are limited in overall scope. It is most pertinent to spills occurring in large water bodies and coastal waters.

The main advantages of CHRIS are summarized as follows:

1. It addresses a large number of chemicals individually and may be applicable to hazardous wastes if the identity of the material is known.
2. Identification and notification procedures are included.
3. Volume 1 is easy to use. It presents information in a consistent format with highlights for important sections.
4. Assessment techniques are presented in a logical complete manner.
5. Detailed containment procedures are included for water spills.
6. Initial response safety procedures, and first aid information is included along with human health information.
7. Potential impacts on water bodies are addressed.

Disadvantages are:

1. Mixtures are not addressed at all, so that applicability to unidentified hazardous wastes is not possible.
2. Spill control procedures are limited to handling spills occurring in large water bodies, and are not generally applicable in other situations.
3. Disposal of spill residuals is not addressed.
4. Extensive background knowledge is required for effective use of Volumes 2 - 4.
5. Placards and labeling are not presented.

EPA Oil and Hazardous Materials - Technical Assistance Data System (OHM-TADS) (24). OHM-TADS is a computerized information retrieval file which contains data for more than 1,000 oily and hazardous substances. The system is on-line with terminals located at various places in the country. There are some problems associated with access to the terminals, especially during non-office hours. It should be accessed through the OSC at the Regional Response Center.

One of the main purposes of OHM-TADS is to provide a method to identify a hazardous material from various physical/chemical characteristics observed on scene. The system automatically takes each word and processes it into an inverted index file, making each word a search component of the data base. As a result of the search, a list of chemicals which meet the input is displayed. Further refinement is then possible.

The information available per chemical is divided into 123 segment headers of which 95 are searchable. The system utilizes input from these various headings to identify chemicals which match the given inputs. By elimination, possible chemical identities are established.

These categories listed in Appendix A; page 42 cover a wide variety of chemical, physical, biological, toxicological and commercial data with the greatest emphasis on the effects on water quality. This information has been compiled from a large number of sources but is not complete for every chemical. In some instances, no data is provided for a certain category.

All of the information presented can be utilized to some extent during a spill response. Useful information is given on storage and handling, corrosiveness, problems with mixtures, hazards, in-situ amelioration actions, and disposal.

Advantages include the following:

1. It addresses a very large number of chemicals individually and may be applicable to hazardous wastes when the identity of the material is known.
2. Some properties of possible mixtures are presented.
3. Identification through computer searching is included.
4. Human health hazard data is presented with data on toxicity, flammability and explosion hazard information.
5. Environmental protection information is presented with data on aquatic toxicity and water pollution affects.

Disadvantages include:

1. The system is not easy to use. Terminals and outputs have limited accessibility with regard to location and time. The printout can be difficult to use, unless the reader has previous familiarity with the format.
2. Detailed assessment, control and disposal information is not provided. Implementation instructions are not included.
3. Mixtures are not addressed in detail so applicability to unidentified hazardous wastes is limited.
4. Notification requirements, legal restrictions, placards and labeling are not explained.

Manual for the Control of Hazardous Material Spills - Volume 1 Spill Assessment and Water Treatment Techniques (25). This manual includes information on many aspects of spill response. The Table of Contents is presented in Appendix A page 45. The primary purpose of this document was to present methods for treating hazardous material spills affecting smaller water bodies. Improvised treatment processes have been developed which allow treatment of a contained spill by pumping the contaminated fluids through the recommended system. The manual also presents a brief review of notification requirements, information sources, identification techniques and assessment procedures.

Notification requirements are discussed in general but not specified. The user is instructed to determine pertinent requirements for the location. A review of available information sources is also included. Identification and assessment sections reference CHRIS but include some detail regarding methods to determine the identity of the spilled chemical associated with various transportation modes.

Alternate spill handling methods are addressed and a situation specific approach to choosing the best one is included. Emphasis is placed on handling a spill in an off-stream but on-site mode. Suggested treatment schemes for 300 chemicals are presented. Instructions for constructing process units from off-the-shelf components are presented in detail. A systems design approach allows establishment of flow rates through one of five unit processes (filtration, carbon adsorption, ion exchange, gravity separation and chemical reaction). Other information presented includes: process component choice, sampling procedures and spill prevention.

This manual attempts to present a tremendous amount of information in a single volume. As a result, the audience addressed changes from the generally uninitiated (in Chapters 1, 2 and 3) to the technical expert (Chapters 4, 5, 6 and 7). The approach is also limited to water spills which can be treated in an off-stream manner, however a complete understanding of the procedures included could allow application of the information to other circumstances.

Advantages include:

1. Detailed instructions for implementing treatment of hazardous spills are included with a decision approach for assessing the best handling methods.
2. Mixtures are mentioned and many of the laboratory procedures can be applied to hazardous waste spills.
3. Most chemicals are addressed individually, so the manual is applicable to hazardous wastes when the identity of the material is known.
4. Notification, identification and assessment procedures are included.
5. Placards and labels are discussed.

Disadvantages are:

1. Initial response information is not presented in detail.
2. Environmental impacts and health hazards are not included.
3. Extensive background knowledge is required for the most effective use of the information.

4. First aid procedures are not presented in detail.
5. Treatment methods are directed to water spills.

Water Quality Accident Handbook - New York State Department of Environmental Conservation (26). The State of New York has prepared a manual for use by their own personnel when responding to spill incidents. This document was not available for direct review by project personnel nor is it considered available to the general public. Therefore a complete evaluation was not possible. A Table of Contents was obtained, from which it is possible to infer that a comprehensive document is available. Topics addressed in the manual include:

1. State and Federal levels of responsibility.
2. Notification, surveillance and communications.
3. Containment and countermeasures.
4. Recovery, clean-up and debris disposal.
5. Investigation and enforcement.
6. Spill prevention control and countermeasure plans.

There is also a section which includes various technical information on groundwater contamination, petroleum products, etc. The contents indicate that the manual includes valuable information but further review is not possible without additional information.

## Detection/Assessment or Disposal Manuals

Some manuals or references have been prepared which address detection/assessment of spill damages or disposal methods. These have been written to meet very specific objectives and are not intended as overall response manuals. Nonetheless, information is included which is of use to those involved in a spill response.

Field Detection and Damage Assessment Manual for Oil and Hazardous Material Spills - Environmental Protection Agency, Division of Oil and Hazardous Materials (27). The primary purpose of this manual is to aid Federal and State officials who are involved with field investigation of damage after a spill. The overall scope is described in the following excerpt from the manual.

"Scope of Manual". The manual consists of seven chapters which deal with methods and procedures, and an appendix which is a compendium of data on hazardous materials.

Chapter 1: Survey. Step-by-step instructions on what to do, from time of arrival until full damage assessment plan is in operation.

Chapter 2: Chemical and Physical Equipment and Techniques for Detection and Identification. What to use in locating a spill and making presumptive identification. The emphasis is on portability and simplicity, for qualitative and semiquantitative analysis. Positive identification and quantitative analysis are not made in the field.

Chapter 3: Sampling. General principles on what and where to sample, for use during planning and through-out the investigation.

Chapter 4: Biological Damage Assessment: Equipment and Techniques. Similar to Chapter 2, but dealing with methods for biological investigation.

Chapter 5: Damage Assessment Procedures. A systematic approach to the application of field investigations to damage assessment.

Chapter 6: Statistics. Comment and guidelines on the use of statistics in the field, and the requirements for a damage assessment report.

Chapter 7: Reporting and Legal Requirements. A checklist of rules for meeting legal requirements, and of details to be included in a damage report.

Appendix A: Dictionary of Hazardous Polluting Substances. Each page deals with a designated substance or closely related group of substances, in alphabetical order. Data are: chemical formula; synonyms; descriptions; toxicity; precautions; and detection methods. The data are those useful in the field: for example, the description emphasizes readily observed properties, and toxicity is in qualitative terms.

Appendix B: Cross Index. This is for use when the spill is known by name or by a group title. The index shows whether there is an entry under that name or whether reference should be made to another entry.

Appendix C: Categorization of Hazardous Polluting Substances. This is for use when the spill is not known by name, The substances in the Dictionary, Appendix A are categorized here by readily observed properties, such as smell and color. The investigator matches his observations with these categories, and finds which substances fit the observations best. The spill may be one of these."

The manual addresses 329 materials. In most cases they are individual compounds but in some instances similar materials are grouped. Hazardous wastes are not addressed directly, however, three types of sludge are included (chemical, digested and raw undigested). The basic use of the manual with respect to planning a field survey, the investigation and report and identification of unknown materials is outlined using a flow chart approach. Very specific information with regard to sampling is included and clearly presented.

It should be emphasized that this manual is intended for damage assessment of a spill after the fact. Spill handling and control are not considered as major objectives although some of the information presented could be used by response personnel. The most noteworthy features in this regard are the identification procedures which are included and the sampling and sample handling information. Basically, the manual is complete for doing damage assessment studies but should not be a primary reference in control situations.

The advantages include:

1. The manual presents information on a wide variety of hazardous chemicals individually. Some may be pertinent to hazardous waste situations, when the identity of the material is known.
2. Human health protection information is given with data on handling hazards and toxicity.
3. An identification procedure was developed and is included.
4. The manual is quite easy to use since the information is presented in a clear manner.

Disadvantage are:

1. Assessment, control and disposal procedures after hazardous spills are not addressed.
2. Mixtures are not considered and the identification techniques are limited to pure substances.
3. Notification procedures and initial response information is not presented.
4. First aid and safety procedures are not included in detail.
5. Placards and labeling are not explained.

Chemical Disposal Techniques for Hazardous Materials - United Parcel Service (28). The manual presents disposal techniques for the Hazardous Materials published as part of DOT Hazardous Materials regulation 49 CFR 172. Approximately 1,000 hazardous materials are addressed in alphabetical order. To use the manual, the chemical name is located and verified by reference to the chemical formula. Then the associated disposal number directs the user to specific disposal information located at the end of the manual. The disposal information includes personnel protection recommendations as well as methods to decontaminate the area affected by the spill. This data is presented by hazard type and subdivided to apply to specific chemicals or classes. The disposal methods are actually control techniques which are limited to handling small amounts of the spilled chemical. Ultimate disposal of the contaminated material is not actually considered.

Treatment chemicals are limited to twelve materials which can be safely handled by uninitiated personnel. Brief information is presented on where they may be obtained.

Basically, the information presented in this manual would be useful to people in confined areas where small amounts of chemicals are handled (shipping rooms, laboratories). In these locations, drains and small con-

tainers are available for disposal after preliminary detoxification. However, even for this limited application, additional safety information may be desirable.
Advantages include:

1. The manual addresses a wide variety of chemicals individually. The information may be applicable to hazardous waste situations if the identity of the material is known.
2. It is easy to use. The chemicals are presented alphabetically and the information does not require extensive background knowledge.
3. Personnel protection equipment is recommended.

Disadvantages are:

1. Identification, assessment and ultimate disposal are not addressed.
2. Mixtures are not considered and the manual is not applicable to unidentified hazardous wastes.
3. Initial response notification and detailed safety procedures are not presented.
4. Environmental impacts and protection are not included.
5. Human health hazards are not presented in detail.

Laboratory Waste Disposal Manual (MCA) (29). This manual has been developed to present information regarding disposal of various hazardous chemical wastes from a laboratory without injury to personnel or excessive contamination of the environment. Approximately 1,200 chemicals are listed and the data is cross-referenced to prevent excessive repetition. A typical page is included in Appendix A; page 48.

Treatment techniques for detoxification prior to disposal are included. The extremely toxic chemicals are generally converted to less toxic materials prior to final disposal. Among the procedures presented are neutralization, adsorption, burning and dilution.

The manual does meet its objective to provide methods for disposal of small quantities of wastes. However, it is not generally applicable to spill situations and its main use is for verification or general reference. The manual has the following advantages:

1. It addresses a wide variety of hazardous chemicals individually and may be applicable to hazardous waste materials when the identity is known.
2. The text is easy to use. Chemicals are presented alphabetically with a consistent format. Previous training is not required for effective use.
3. Human health information with respect to flammability, explosion hazard and toxicity are included.

Disadvantages are:

1. Mixtures are not covered at all. Applicability of this manual to unidentified hazardous wastes is difficult.

2. Environmental impacts and protection are not addressed.
3. Identification, assessment and control of hazardous spills is not presented in detail.
4. Disposal techniques are most applicable to small volume spills.
5. Initial response information including firefighting procedures, safety and notification requirements is not included.

Recommended Methods of Reduction, Neutralization, Recovery or Disposal of Hazardous Waste - EPA Report No. 670/2-73-053 (30). This 16 volume reference does not deal directly with hazardous materials spills, but is useful for identifying potential treatment and disposal processes for various materials. Generalized waste streams are not addressed, instead chemical constituents are considered separately.

Methods for handling these chemicals are evaluated. Profile reports presenting the general manufacturing processes and treatment methods have been prepared. Over 500 chemicals are addressed and recommended treatment techniques are summarized in a large table.

Evaluation of this source identifies that it is not a spill response reference. However, the information which it presents is extremely useful to those who must determine methods for clean-up and disposal for various hazardous materials.

Advantages include:

1. The source presents information on hazardous chemicals individually. The information may be pertinent to hazardous wastes if the identity is known.
2. Human health information on toxicity, flammability and explosion hazards is included.
3. Some environmental impact information is included.
4. Good background information is presented.
5. Methods for treatment and disposal are discussed and summarized.

Disadvantages are:

1. Identification, assessment, control and disposal procedures for hazardous spills are not included.
2. Mixtures are not addressed. The applicability to unidentified hazardous wastes is minimal.
3. The source is not easy to use. It requires the user to have extensive background knowledge and has a confusing index.
4. Notification procedures and legal requirements are not presented..
5. Initial response information including firefighting techniques, safety hazards and immediate first aid are not included.

## General Summary

From this information, it can be seen that there are many different resources available which provide input regarding spill response. Most have been developed to meet varying objectives and, therefore, have limited overall applicability. A general overview of the reviewed response manuals and information sources' capabilities is presented in Table 8. The table headings are described as follows:

| | |
|---|---|
| TITLE. | An abbreviated title of the information source or response manual in order of discussion. |
| TYPE OF DATA BASE. | This includes an indication of whether a book, computer, or file system is the basic mode of operation. |
| MATERIALS ADDRESSED. | The number of compounds are considered, as well as the type of materials. Type refers to pure materials addressed individually, classification of materials (i.e., flammable liquids or wastes). A separate category is included which establishes if a manual addresses unidentified mixture of hazardous wastes. Spoiled batches and spent chemicals would generally be included if the manual considered pure chemicals, so this heading is limited to unidentified wastes. |
| ACCESS. | The availability of a 24-hour contact, either by telephone or other method is indicated. In addition, the ability of the general public to access the system is presented. |
| INPUT NEEDED. | The required types and amount of input information required to access the data is summarized. Among the most critical variables is the need to know the chemical identity before the system is accessed. Input may also require some spill input variables (weather, wind velocity, population centers nearby, etc.) or an estimate of the volume of chemical spilled. The use of labels or placards as input to the chemical information is also included. |
| OUTPUT: HAZARDS | Among the initial hazard type output is an available procedure to identify the chemical spilled. This may require chemical input data or information on various physical properties. Other potential outputs may involve reference to other information sources or other technical input. Safety procedures to be followed may be indicated, as well as toxicity information or flammability/explosiveness hazards. Another important output at this point may be the name of the manufacturer so that further chemical information can be obtained. |

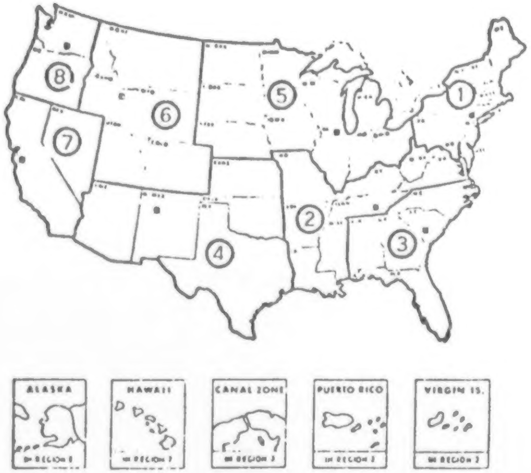
| | |
|---|---|
| OUTPUT: INITIAL RESPONSE. | The information considered in this category were those steps which were to be performed during the initial time at an accident scene. Among considerations were methods for determining evacuation distances, directions for applying containment techniques, input on what safety equipment or procedures were necessary for response personnel and first aid techniques. Environmental protection information included those type of outputs which encouraged reduction in the impact on air, water or land resources. Diking instructions, aquatic toxicities, plume travel, etc. were included. |
| OUTPUT: CLEAN-UP. | This section tabulated secondary or additional responses to a spill incident. First, the amount of detailed information on clean-up techniques was considered, then it was determined if the information available was pertinent to treatment but did not actually address techniques which could be utilized (related information). If criteria for evaluating the specific situation were utilized before the final control technique was chosen, this was considered a decision approach to clean-up. Finally, the amount of information pertinent to disposal methods was addressed. |
| EXPERTISE OF AUDIENCE | In this category, the general expertise level needed to use the various manuals and information sources was estimated. |

TABLE 5. SELECTED INFORMATION RETRIEVAL SYSTEMS

| Information Source | On-line computer system | Contact |
|---|---|---|
| Lockheed Information Systems | yes | 415/493-4411<br>Ext. 45635 |
| Editec Inc. | yes | 312/427-6760 |
| Illinois Institute for Environmental Quality Library | yes | 312/793-3870 |
| Institute for Scientific Information | yes | 215/923-3300 |
| NIOSH Technical Information Center | yes | 301/443-3063 |
| National Technical Information Service | yes | 202/967-4349 |
| National Emergency Equipment Locator System (NEELS-Canadian) | yes | 819/997-3742 |
| National Analysis of Trends in Emergencies System (NATES-Canadian | yes | 819/997-3742 |
| NASA - Scientific & Technical Information Office | yes | 202/755-3548 |
| NASA - Indus. Applications Cntrs: | | |
| Univ. of Conn., Storrs, CT | yes | 203/486-4533 |
| Research Triangle Park, NC | yes | 919/549-8291 |
| Univ. of Pittsburg, PA | yes | 412/624-5211 |
| Indiana Univ, Bloomington, IN | yes | 812/337-7774 |
| Univ. of N. Mexico, Albuquerque | yes | 505/277-3622 |
| Univ. of S. Cal, Los Angeles, CA | yes | 213/746-6132 |
| Global Engineering Documentation Services | no | 714/540-9970<br>213/624-1216 |
| U.S. Dept. of Commerce Maritime Administrator | no | 212/967-5136 |
| National Bureau of Standards Fire Technology Library | no | 301/921-3246 |
| NASA/Aerospace Safety Research & Date Institute | no | 216/443-4000<br>Ext. 285 |
| Chemical Abstract Service Ohio State University | no | 614/421-6940 |
| Computer Search Center Illinois Institute of Tech. Research Institute | no | 312/225-9630 |
| Fire Rsearch Section Southwest Research Institute | no | 512/684-5111<br>Ext. 2415 |
| Environmental Engineering Div., Texas A&M University | no | 713/845-3011 |
| Toxicology Data Bank, Natl. Library of Medicine | no | 301/496-1131 |

TABLE 6. SOURCES OF INFORMATION AND ASSISTANCE FOR HAZARDOUS MATERIAL SPILLS (25)

| Information source | Organization | Type of Information Assistance | Access |
|---|---|---|---|
| Interagency Regiological Assistance Plan (IRAP) | Federal | 1,2 | 1. CHEMTREC 800/424-8300 (202/483-7616 in Washington, D.C.)<br>2. Regional Offices: |



| | Office | P.O. Address | Telephone | DDD Area Code |
|---|---|---|---|---|
| 1. | Brookhaven Area Office | Upton L.I.<br>New York 11973 | 345-2200 | 516 |
| 2. | Oak Ridge Oper. Office | P.O. Box E<br>Oak Ridge, TN<br>37830 | 480-8617<br>Ext. 4510 | 615 |
| 3. | Savannah River Ooerations Office | P.O. Box A<br>Aiken, S.C.<br>29801 | N. August, SC<br>824-6331<br>Ext. 3333 | 803 |
| 4. | Albuquerque Operations Office | P.O. Box 5400<br>Albuquerque<br>New Mexico 87115 | 264-4667 | 505 |
| 5. | Chicago Operations Office | 9300 S. Cass Ave.<br>Argonne<br>Illinois 60439 | | 312 |
| 6. | Idaho Operations Office | P.O. Box 2108<br>Idaho Falls<br>Idaho 83401 | 526-0111<br>Ext. 1515 | 208 |
| 7. | San Francisco Operations Office | 2111 Bancroft Way<br>Berkeley<br>California 94704 | 841-5121<br>Ext. 664 duty hrs<br>841-9244 off hrs | 415 |
| 8. | Richland Operations Office | P.O. Box 550<br>Highland<br>Washington 99352 | 942-7381 | 509 |

continued

TABLE 6. (continued)

| Information Source | Type of Organization | Type of Information Assistance[a] | Access |
|---|---|---|---|
| EPA Oil and Hazardous Materials - Technical Assistance Data System (OHMTADS) | Federal | 2-A | EPA Regional Office |
| Lockheed Information Systems | Commercial | 3-A | 415/493-4411<br>Ext. 456635 |
| Missouri Pacific Railroad Information System | | | |
| Chemical Transportation Emergency Center (CHEMTREC) | Privately sponsored | 2,3 | Through CHEMTREC 800/424-9300 (in Washington, D.C. 202/483-7616 |
| Transportation Emergency Assistance Plan (TEAP) | Canadian, privately sponsored | 1,2,3, | Each regional Control Center has 24 hour number:<br>1. Hooker Chemicals Division Vancouver, British Columbia 604/929-3441; geographic location: British Columbia<br>2. Celanese Canada Ltd., Edmonton, Alberta 403/477-8339; geographic location: Prairie Provinces<br>3. Canadian Industries Ltd., Copper Cliff, Ontario 705/682-2881 geographic location: Northern Ontario |

continued

TABLE 6. (continued)

| Information Source | Type of Organization | Type of Information Assistance [a] | Access |
|---|---|---|---|
| | | | 4. Dow Chemical of Canada, Ltd., Sarnia, Ontario 519/339-3711 geographic location: Central Ontario |
| | | | 5. Cyanamid of Canada, Ltd., Niagara Falls, Ontario; 416/356-8310 geographical location: Eastern Ontario |
| | | | 6. DuPont of Canada, Ltd., Maitland, Ontario; 613/348-3616; geographical location: Western Ontario |
| | | | 7. Allied Chemical Canada Ltd., Valleyfield, Quebec, 514/373-8330; geogrpahical location: Quebec - south of St. Lawrence |
| | | | 8. Gulf Oil Canada Ltd., Shawinigan, Quebec, 819/537-1123; geographical location; Quebec, north of St. Lawrence |

[a] 1. Respond to scene with trained personnel if required.
2. Provide information on identity, hazards, or what to do.
3. Refer to knowledgeable contact.
4. On-line computer available.

continued

TABLE 6. (continued)

| Information Source | Type of Organization | Type of Information Assistance | Access |
|---|---|---|---|
| Chlorine Emergency Plan (CHLOREP) | Privately sponsored | 1,2,3 | Through CHEMTREC - 800/424-9300 (in Washington, D.C. 202/483-7616 |
| National Agricultural Chemists Association (NACA) Pesticides Safety Team Network | Privately sponsored | 1,2,3 | Through CHEMTREC 800/424-9300 (in Washington, D.C. 202/483-7616 |

a. 1. Respond to scene with trained personnel if required.
2. Provide information on identity, hazards, or what to do.
3. Refer to knowledgeable contact.
4. On-line computer available.

## TABLE 7. SOME ADDITIONAL SOURCES OF BACKGROUND INFORMATION

1. Chemical Rubber Corporation, Handbook of Chemistry and Physics, CRC Press
2. Handbook of Chemistry - Handbook Publishers Inc. by NA Lange
3. Behavior of Organic Chemicals in the Aquatic Environment - Part I - A Literature Critique, Manufacturing Chemists' Association
4. Behavior of Organic Chemicals in the Aquatic Environment - Part II - Behavior in Dilute Solutions, Manufacturing Chemists' Association, April 1968
5. Chemical Engineers' Handbook, Perry, John H. et al., eds., 1973.
6. Handbook of Analytical Toxicology, Sunshine, I., ed., Chemical Rubber Co., 1969
7. Mineral Facts and Problems, US Bureau of Mines Bull. 630, 1065
8. Organic Chemistry, Morrison, R.T., and R.N. Boyd, 2nd ed., 1966
9. The Pesticide Review, US Dept. of Agriculture, 1970
10. Hygienic Guide Series, American Industrial Hygiene Association
11. Proceedings of Conference on Hazardous Cargos, (US Coast Guard) July, 1970, New London, CT
12. Proceedings of the various National Conferences on Control of Hazardous Material Spills (For the EPA).
13. Spill Prevention Techniques for Hazardous Polluting Substances, (For the EPA), Arthur D. Little Co.
14. Standard Methods For the Examination of Water and Wastewater, American Public Water Works, and Water Pollution Control Federation
15. Water Quality Criteria, McKee, J.E. and H.W. Wolf, The Resources Agency of California, State Water Quality Control Board
16. Water Quality Criteria - Report of the National Technical Advisory Committee to the Secretary of the Interior, April 1, 1968, F.W.P.C.A., Wash.
17. Pollution and Marine Ecology, Olson, T.A. and R.J. Burgess, 1967
18. Control of Spillage of Hazardous Polluting Substances, 15090 FOZ (for the EPA), Battelle Memorial Institute

TABLE 8. SUMMARY OF CAPABILITIES OF MANUALS AND INFORMATION SERVICES

| Title | Type of Data Base | Materials Addressed |  |  | Access |  | Input Needed |  |  |
|---|---|---|---|---|---|---|---|---|---|
|  |  | number | type | Hazardous Wastes | 24 hr. avail | General Public | Identity of Material | Spill Site Variables | Volume Spilled |
| 1. CHEMTREC | advice | 3600 | pure | No | Yes | Yes | Yes | No | No |
| 2. TEAP | advice |  |  | No | Yes | Yes | Yes | -- | -- |
| 3. Mo. Pac. Railroad | automated |  | pure | No | Yes | No | Yes | No | No |
| 4. CHLOREP | personal | chlorine forms | chlorine products | No | Yes-CHEMTREC | No | no, chlorine related | Yes | Yes |
| 5. IRAP | personal |  | radioactive matl. | No | Yes-CHEMTREC | Yes | recommended | Yes | recommended |
| 6. Lockheed Info. Systems | files | 60 |  | No | No-100+hr/wk | Yes |  | No | No |
| 7. Dang. Prop. of Haz. Matls. | book | 13000 | pure/mixture | No | Yes | Yes | Yes | No | No |
| 8. Merck Index | book | 9856 | pure | No | Yes | Yes | Yes | No | No |
| 9. Toxic & Haz. Ind. Chem. Safety Manual | book | 702 | pure | No | Yes | Yes | Yes | No | No |
| 10. Chemical Safety Data Sheets | cards | 86 | pure | No | Yes | Yes | Yes | No | No |
| 11. Chemistry of Haz. Matls. | textbook | 50 approx. | pure/mixture | No | Yes | Yes | Yes | No | No |
| 12. Fire Officers Guide to Dangerous Chem. | textbook | 11 | classes | No | Yes | Yes | Yes | Yes | No |
| 13. Haz. Materials | textbook | 22 | classes | No | Yes | Yes | Yes | Yes | Yes |
| 14. Em. Handling of Haz. Matls. in Surface Transportation (AAR) | book | 2000 | chemicals/classes | Some | Yes | Yes | Yes | No | No |
| 15. Guidelines to the Handling of Haz. Materials | book | 1500 | pure | No | Yes | Yes | Yes | No | No |

continued

## TABLE 8. (continued)

| Title | Type of Data Base | Materials Addressed | | | Access | | Input Needed | | |
|---|---|---|---|---|---|---|---|---|---|
| | | number | type | Hazardous Wastes | 24 hr. Avail. | General Public | Identity of Material | Spill Site Variables | Volume Spilled |
| 16. Hazardous Materials Handbook | book | 1500 | chemical materials | No | Yes | Yes | Yes | No | No |
| 17. Hazardous Materials Safety Manual | pamphlet | 15 | classes | No | Yes | Yes | Yes | No | No |
| 18. National Fire Codes | book | 250<br>34 class. | combustible chemicals | No | Yes | Yes | Yes | Yes | Yes |
| 19. Haz. Matls Emergency Action Guide | bulletin | 43 | pure | No | Yes | Yes | Yes | Yes | Yes |
| 20. Haz. Matls. Transp. Emergencies-TC | training course | -- | -- | No | No | No | | Not Applicable | |
| 21. Chemcards (Cargo Information Card) | card | -- | pure | No | Yes | Yes | Yes | No | No |
| 22. Guide on Haz. Matls - NFPA | bulletin | -- | -- | No | Yes | Yes | Yes | No | No |
| 23. Tremcards | cards | 13 | chemical wastes | Yes | Yes | Yes | Yes | No | No |
| 24. CHRIS | 4 books | 400 | pure | No | Yes | Yes | Yes | Yes | Yes |
| 25. OHM-TADS | automated | 1000 | pure & oil | No | No | No | Yes, phy chem prop | No | No |
| 26. EPA - Manual for Control of HM Spills | book | 300 | pure | No | Yes | Yes | Yes | Yes | Yes |
| 27. Field Detection Manual | book | 329 | pure | -3- | Yes | Yes | Yes, phy prop. | No | No |
| 28. Chem. Disposal Techniques (UPS) | book | 1000 approx. | pure | No | Yes | Yes | Yes | No | No |
| 29. MCA Laboratory Waste Disposal Manual | book | 1200 | pure | No | Yes | Yes | Yes | No | No |
| 30. TRW Report | book | 500 | pure | No | Yes | Yes | Yes | No | No |

continued

## TABLE 8. (continued)

| | Output - Hazards | | | | | | Output - Initial Response | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Title | Identif. Proc. Avail | Further Information | Safety Procedures | Toxicity | Explosive Flammable | Manuf. Name | Evacuation | Containment (details) | Safety Equip. | First Aid | Environ. Protection |
| 1. CHEMTREC | No | No | Yes | No | | | No | No | No | Yes | No |
| 2. TEAP | | | | | | Yes | | | | | No |
| 3. Mo. Pac. Railroad | No | Yes | -- | -- | Yes | -- | Yes | general | | | No |
| 4. CHLOREP | Yes | Advice | Yes | Yes | Yes | can be contacted | Yes | Yes | Yes | Yes | No |
| 5. IRAP | Yes | Advice | Yes | Yes | Yes | contact | Yes | Yes | No | Yes | No |
| 6. Lockheed Info. Systems | No | Yes | Depends on Available Abstracts | | | | | | | | No |
| 7. Dang. Prop. of Haz. Matls. | No | No | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes | No |
| 8. Merck Index | No | Yes | No | Yes | No | No | No | No | No | No | No |
| 9. Toxic & Haz. Ind. Chem. Safety Manual | No | Yes | Yes | Yes | Yes | No | Yes | No | Yes | Yes | Yes |
| 10. Chemical Safety Data Sheets | No | Yes | Yes | Yes | Yes | No | No | No | Yes | Yes | Yes |
| 11. Chemistry of Haz. Matls. | Yes | Yes | No | Yes | No | No | No | No | No | No | No |
| 12. Fire Officers Guide to Dangerous Chem. | No | Yes | Yes | Yes | Yes | No | No | Yes | Yes | No | No |
| 13. Haz. Materials | No | Yes | Yes | Yes | Yes | No | No | Yes | Yes | Yes | Yes |
| 14. Em. Handling of Haz. Matls. in Surface Transportation (AAR) | No | Yes | Yes | No | Yes | No | Yes | Yes | Yes | No | Yes |
| 15. Guidelines to the Handling of Haz. Materials | No | Yes | Yes | No | Yes | No | No | No | No | Yes | No |

continued

TABLE 8. (continued)

| Title | Output - Hazards | | | | | | Output - Initial Response | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Identif. Proc. Avail | Further Information | Safety Procedures | Toxicity | Explosive Flammable | Manuf. Name | Evacuation | Containment (details) | Safety Equip. | First Aid | Environ. Protection |
| 16. Hazardous Materials Handbook | No | No | Yes | Yes Brief | Yes | No | No | No | No | No | No |
| 17. Hazardous Materials Safety Manual | No | No | Yes | No | Yes | No | Yes | No | Yes | Yes | No |
| 18. National Fire Codes | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes | No |
| 19. Haz. Matls Emergency Action Guide | No | No | Yes | Yes | Yes | | Yes | Yes | No | Yes | No |
| 20. Haz. Matls. Transp. Emergencies-TC | | | | | | | | | | | |
| 21. Chemcards (Cargo Information Card) | No | No | Yes | No | Yes | No | Yes | No | No | Yes | Yes |
| 22. Guide on Haz. Matls - NFPA | No | No | Yes | No | Yes | Yes | Yes | No | Yes | Yes | No |
| 23. Tremcards | No | No | Yes | No | Yes | No | Yes | Yes | No | Yes | Yes |
| 24. CHRIS | Yes | references | Yes | Yes | Yes | | Yes | Yes | No | Yes | Yes |
| 25. OHM-TADS | Yes | many sources given | Yes | Yes | Yes | | Yes | No | No | | Yes |
| 26. EPA - Manual for Control of HM Spills | Yes | many sources given | Yes | No | No | No | No | Yes | No | No | Yes |
| 27. Field Detection Manual | Yes | No | No | No | No | No | No | No | No | No | Yes |
| 28. Chem. Disposal Techniques (UPS) | No | No | Yes | Yes | No | No | No | No | Yes | No | Yes |
| 29. MCA Laboratory Waste Disposal Manual | Yes | Yes | Yes | Yes | Yes | No | No | No | Yes | No | Yes |
| 30. TRW Report | No | No | No | No | No | No | No | No | No | No | Yes |

continued

## TABLE 8. (continued)

| Title | Output - Clean-Up | | | | | Expertise of Audience |
|---|---|---|---|---|---|---|
| | Detailed Inst. | Related Info. | Decision Approach | Disposal Methods | Other | |
| 1. CHEMTREC | No | No | No | No | | lab personnel |
| 2. TEAP | | | advice | | | |
| 3. Mo. Pac. Railroad | general | | | | | police, fire personnel |
| 4. CHLOREP | Yes | | technical advice | gas dissipation | | |
| 5. IRAP | | | advice | advice | | first person, communication |
| 6. Lockheed Info. Systems | extensive abstracts | | No | small scale information | | expert |
| 7. Dang. Prop. of Haz. Matls. | No | No | No | No | No | chemist, engineer |
| 8. Merck Index | No | No | No | No | No | chemist |
| 9. Toxic & Haz. Ind. Chem. Safety Manual | No | Yes | No | No | No | chemist |
| 10. Chemical Safety Data Sheets | No | No | No | No | No | chemist, engineer |
| 11. Chemistry of Haz. Matls. | No | No | No | No | No | fire fighter<br>technical personnel |
| 12. Fire Officers Guide to Dangerous Chem. | No | No | No | No | No | fire fighter |
| 13. Haz. Materials | No | No | No | No | No | fire fighter |
| 14. Em. Handling of Haz. Matls. in Surface Transportation (AAR) | No | No | No | No | stopping tank leaks | carrier<br>fire fighter |
| 15. Guidelines to the Handling of Haz. Materials | No | No | No | No | No | carrier<br>emergency personnel |

continued

## TABLE 8. (continued)

| Title | Output - Clean-Up<br>Detailed Inst. | Related Info. | Decision Approach | Disposal Methods | Other | Expertise of Audience |
|---|---|---|---|---|---|---|
| 16. Hazardous Materials Handbook | No | No | No | No | No | fire fighter |
| 17. Hazardous Materials Safety Manual | No | No | No | No | | emergency personnel |
| 18. National Fire Codes | No | No | No | No | No | fire fighter<br>technical personnel |
| 19. Haz. Matls Emergency Action Guide | simple approach | | No | No | | average person |
| 20. Haz. Matls. Transp. Emergencies-TC | Not Applicable. | | | | | |
| 21. Chemcards (Cargo Information Card) | No | No | No | No | No | carrier |
| 22. Guide on Haz. Matls - NFPA | No | No | No | No | No | fire fighters |
| 23. Tremcards | No | Yes | No | No | No | carriers |
| 24. CHRIS | Yes | | No | Some | | technical |
| 25. OHM-TADS | Yes, but broad | | No | No | | technical |
| 26. EPA - Manual for Control of HM Spills | Yes | Yes | Yes | No | Yes | technical |
| 27. Field Detection Manual | No | No | No | No | No | technical |
| 28. Chem. Disposal Techniques (UPS) | No | Yes | No | No | Yes | carriers |
| 29. MCA Laboratory Waste Disposal Manual | Yes | Yes | Yes | Yes | No | technical |
| 30. TRW Report | Yes | Yes | Yes | Yes | No | technical |

## SECTION V

## RESPONSE TEAMS - CAPABILITIES SUMMARY

### General

Various groups have been developed which are capable of actual on site spill response. These response teams can be sponsored by the government, industrial associations or specific private industries. Their accessibility to the general public, capability to handle different spilled chemicals or wastes, and available equipment are quite variable. Representative response teams for these different groups have been reviewed and their capabilities have been summarized. A brief evaluation focusing on the response team capability to respond to hazardous waste spills is included in Section VI.

### Federal Response Teams

Various agencies within the Federal government have sponsored response teams which are capable of handling different types of emergencies. Specific agencies involved include the EPA, Department of Transportation, Department of Defense, and Department of Energy.

National/Regional Response Teams. Both National and Regional Response Teams (NRT or RRT) have been mandated by the Council on Environmental Quality in their National and Regional Contingency Plans. These teams are designated to perform various planning, preparedness and response functions. The RRT consists of representatives from designated primary agencies and selected advisory agencies. The defined functions of these teams are specified as follows (31).

### Planning and Preparedness functions

1. "Develop procedures to promote the coordinated actions of all Federal, State, and local government and private agencies in response to pollution incidents.
2. Assist in the preparation of amendments to this Plan.
3. Review reports from the On-Scene Coordinator on the handling of major spills and pollution incidents for the purposes of analyzing response actions and recommending needed improvements in the contingency plans.

Response functions

1. Monitor incoming reports and evaluate the possible impact of such spills. Maintain an awareness of proposed actions of the On-Scene Coordinator.

2. Coordinate the actions of the various agencies in supplying needed assistance to the On-Scene Coordinator. Assistance will normally be obtained through the appropriate member of the Regional Response Team.

3. Provide advice as required of the On-Scene Coordinator (OSC) and recommend courses of action for consideration by the On-Scene Coordinator. The Regional Response Team, however, has no direct operational control over the On-Scene Coordinator.

4. Determine the nature and extent of Federal response required.

5. Recommend deployment of personnel to monitor the handling of the spill.

6. Request other agencies and groups to consider taking appropriate response action.

7. Determine when a shift of On-Scene coordination from the pre-designated OSC is indicated by circumstances and designate the appropriate OSC.

8. Provide a focal point for public realtions."

As expected, the degree of response is dependent upon the particular situation. The actual response activities which involve Federal efforts are to be directed by a predesignated regional On-Scene Coordinator (OSC). The Regional Contingency plan specifies OSC's activities are also defined in the appropriate contingency plan (31).

1. "In the event of a discharge of oil or hazardous polluting substance, the first Federal official on the site shall assume coordination of activities under the Plan until the arrival of the OSC.

2. The OSC shall determine pertinent facts about a particular spill, such as its potential impact on human health and welfare, the nature, amount, and location of material discharged, the probable direction and time of travel of the material, the resources and installations which may be affected and the priorities for protecting them.

3. The OSC shall initiate and direct as required Phase II, Phase III and Phase IV operations (as outlined in the Plan). Advice provided by the EPA representative on the RRT on use of chemicals in Phase III and Phase IV operations in response to discharges of oil or hazardous substances shall be binding on the OSC, except as provided for by Annex X.

4. The OSC shall call upon and direct the deployment of needed resources in accordance with the regional plan to evaluate the magnitude of the discharge and to initiate and continue removal operations.

5. The OSC shall provide necessary support activities and documentation for Phase V activities.

6. In carrying out this Plan, the OSC will fully inform and coordinate closely with RRT to ensure the maximum effectiveness of the Federal effort in protecting the natural resources and the environment from pollution damage."

It is through this mechanism that most federal spill responses are to be handled. If additional manpower is needed, provisions are included to form a National Strike Force (NSF) consisting of three USCG Strike Teams and an EPA Environmental Response Team (ERT).

U. S. Coast Guard National Strike Force (NSF) (DOT sponsored). The Strike Force has been formed as mandated by the National Contingency Plan established by CWA section 311. It includes high seas equipment and personnel to assist in spill containment, cleanup, disposal and documentation/cost recovery. There are three strike teams located in the country (Atlantic, Pacific and Gulf Coast). Each team consists of 18 or 19 men of which 3 to 4 are officers. The teams are available at the request of a Federal OSC as submitted through the National Response Center. Once summoned, the team can respond with 1 or 2 people immediately, four or more people within two hours and can be at full strength in 12 hours. The team is familiar with the use of the CHRIS manuals and is able to provide communications support and assistance as well as advice on ship salvage, diving and removal techniques.

The NSF is equipped mainly for response to ocean incidents. Available equipment is designed for air transport, including:

1. Air Deliverable Antipollution Transfer System (ADAPTS), consists of a pumping system to off-load stricken cargo vessels.

2. Yokohama fender, used for side protection during vessel-to-vessel cargo transfer.

3. High-seas containment barrier.

4. High seas skimmer.

When responding to an incident, their major priorities are to protect:

1. The general public
2. Their own personnel
3. Property
4. Navigability of a given waterway

They generally respond about 2-6 times/month, although many responses are not to major spills. Most of their experience has been with oil spill cleanup.

U.S. Army Technical Escort Center Chemical Emergency Response Team. The U.S. Army Technical Escort Center maintains a fourteen man alert team at the Aberdeen Proving ground in Maryland which is ready to respond to pertinent chemical emergencies within two hours after alert. The team has the most expertise in handling military chemicals or chemical agents since its major function is to assist Army personnel in the event of an emergency situation. The team is not generally available to the public without a special request through the U.S. Army.

The team is specially trained, has available protective clothing, tanks, pumps, and detoxifys the waste prior to proper disposal. Incineration can often be employed. However, it was emphasized that no action is taken or recommended until the identity of the substance is known and verified.

The Escort Center's response team is activated only by direct order of a higher command. To obtain the assistance of the team, initial contact should be made to the regional EPA office. EPA personnel then contact the Army Operations center who determines if the response team is needed. If the decision is made to respond, the team is commanded and dispatched. Funding of the activity is handled through the Army, and the frequency of response is quite low. No major activity has been performed in the last two - three years although some advisory assistance has been given.

Interagency Radiological Assistance Plan (IRAP). The Interagency Radiological Assistance Plan (IRAP) has been developed to assist response personnel dealing with radiation emergencies. It is operated and funded through the Department of Energy. Response has been coordinated in eight regional offices located in different geographical locations throughout the U.S.

IRAP is accessed through 24 hour telephone numbers in each region or through CHEMTREC (see Table 6 for telephone numbers). The caller is requested to supply 1) name and title of caller, 2) call back number, 3) location and magnitude of the problem, 4) information from shipping papers (type of material, manufacturer or shipper, carrier). From this input, the duty officer determines the potential hazard of the situation. When minor hazards are involved, the caller may be advised over the telephone. If the situation appears serious, the response team may be dispatched within 15 minutes to one hour.

The main responsibilities of the response team are to give technical advice, supervise activities (if needed), assess the hazard and inform people regarding the degree of hazard. Their available equipemnt includes protective clothing and radiation measurement kits with alpha, beta and gamma or geiger counters.

IRAP receives approximately 40-50 calls per year but teams may be dispatched to one site per year. Most spills to date have occurred on land and are often of small size. However, IRAP personnel feel that they are capable of handling larger emergencies if they occur.

## Industrial Spill Response Groups

Industries involved in the production of various hazardous materials often have the most expertise with regard to proper ways to mitigate a spill situation. As a result, many State or Federal OSC's will contact the manufacturer directly to determine the best control techniques. Many industries have recognized that their input can be valuable in a spill or emergency and have developed approaches for handling these situations. One technique has been the formation of a cooperative response mechanism specific to a particularly hazardous product. This approach is utilized by chlorine and pesticide manufacturers. Cooperation through MCA and CHEMTREC is also common for the industry. Some companies have developed their own in-house spill response teams who respond with technical advice plant or transportation spills of the companies own product line. Some of these groups are available to help OSC's or others in an emergency situation.

Chlorine Emergency Plan (CHLOREP). Chlorine manufacturers in both the U.S. and Canada have established the Chlorine Emergency Plan to handle emergencies associated with chlorine. The approach involves mutual aid between manufacturers, since the manufacturer closest to the scene is involved even if it is another's product. Trained teams equipped with necessary personnel safety equipment and special capping devices are available through the plants on a 24 hour basis.

To activate the team, CHEMTREC should be called. At that point, CHEMTREC will notify the closest manufacturer. The CHLOREP representative then contacts the personnel at the scene to determine if it is necessary to provide on site assistance. Most actions are limited to leak stopping since chlorine gas spills are difficult to treat. The gas is then allowed to dissipate after proper safety precautions have been taken.

NACA Pesticides Safety Team Network. A national pesticide information and response network is operated by the National Agricultural Chemicals Association. The network is designed to offer information or on site response, if needed, to a wide variety of pesticide spill incidents. As with CHLOREP, local manufacturers will respond on scene to a spill incident even if it does not involve their own product.

The network is accessed through CHEMTREC and has available 24 hour telephone numbers for emergency response (see Table 6 for numbers). Upon notification of an incident, action information will be relayed over the telephone. If necessary, a response team is dispatched to the site. The funding for this response is provided by the industries.

The industrial representatives rely on their own expertise when handling a specific material. Depending on the situation, they may dike an area and then detoxify or reduce the hazards using fire fighting chemicals or neutralizing chemicals (soda ash, lye, clay, bleach, lime). Most of their involvement is associated with land spills and their equipment reflects this. Besides protective clothing and self contained breathing apparata, they are equipped with shovels, brooms, etc. Detoxification usually involves some treatment of the spilled chemical followed by disposal at an acceptable site. It was estimated that they are involved on either an advisory or direct response level on approximately 150 spills per year.

Vinyl Chloride. A cooperative group is being formed for response to spills of vinyl chloride. The program has not been formalized and further information is not readily available.

In-House Industrial Groups (IHIG). Some of the large chemical manufacturers have developed their own in-house response teams for handling chemical emergencies. These teams will offer technical advice to those performing the clean-up but seldom get involved in the actual work effort. The efforts of these teams are usually controlled through the corporate offices. Due to the expense of maintaining these operations, small chemical companies do not usually have a response group (32).

Prevention and clean-up of in-plant spills is usually given higher priority than those associated with transportation emergencies. Many industries have begun to develop spill prevention control and countermeasure (SPCC) plans for hazardous substances in addition to oil. Various dikes and drainage systems have also been installed to reduce the problems of out-of-plant contamination.

The chemical companies programs usually include a 24 hour telephone number manned by a trained operator. Response personnel are predesignated and must be available for emergency notification. Because large companies have various plants across the country, the personnel can respond quickly.

One example of an industrial response program is the "HELP" plan established by Union Carbide. This is a program where personnel are trained in detail how to handle various spill events of Union Carbide chemicals in transit or storage. A total of about 60 people located at various plants throughout the company are active in this program.

Each team consists of 2 people who are equipped with personnel protection equipment such as Scott air packs. They also have drum overpacks, extra safety relief valves, chemical pumps and patching material. Generally, field work by the teams is limited to plugging leaks. The remainder of the teams' activities are supervisory in nature. A 24 hour telephone number is available from which technical people are notified. Advice can be given over the telephone immediately and the teams usually can be deployed within a few hours. All team team members have a primary knowledge of the chemicals they deal with. The manufacturers' product specialists are available to advise on scene personnel at any time. Union Carbide consults on about 25 spills per month, although less than one spill per month is large.

The usefulness of IHIG for hazardous waste spill clean-up is dependent upon the nature of the waste material. If the waste is relatively pure, the expertise would be directly applicable. However, when mixtures of wastes from different processes are involved, the information must be carefully interpreted. These groups offer advice, not clean-up services. In an emergency, their familiarity with chemical problems and advance training is desirable for both pure chemical and hazardous waste spills.

## Private Industrial Contractors

Various private companies have been developed for the purpose of supplying spill clean-up or disposal services to a client. Many companies are involved as third party contractors for clean-up of oil spills and several states have lists of these companies which the spiller can contact for clean up at a specific site. These contractors are well equipped to handle oil spills and have developed a high degree of expertise. Clean-up contractors for hazardous materials or waste spills are not as numerous, and it is these companies which have been included in this review.

After clean-up of spilled materials or if clean-up is not possible, the residuals must be disposed of in acceptable facilities. As a result, disposal firms also get involved in spill response. These groups have also been considered in this evaluation.

During the course of this project, various firms involved in spill response or disposal were contacted to determine their basic capabilities with respect to handling hazardous waste spills. A list of those contacted and their basic involvement is presented in Table 9. No attempt has been made to evaluate their capabilities instead, this brief overview has been prepared to alert a user to the potential availability of both third party contractors and disposal firms who may help mitigate hazardous waste spills.

Spill Clean-up Firms. There are various companies who offer services for clean-up of hazardous material spills. Some of these were originally involved in oil spill clean-up and others were developed specifically for response to hazardous materials incidents. All have available 24 hour emergency telephone numbers and the ability to respond to spills quickly and efficiently. Available equipment ranges from excavation machinery to booms and sorbents to pumps, tanks and (in one case) a mobile carbon absorption system. Generators, compressors and personnel safety equipment are also common. Most firms offer back-up laboratory services (either in-house or contracted) as well as on site clean-up crews.

The mode of operation is flexible. Proprietary treatment techniques are usually not divulged. Some companies have developed their own information sources which are also proprietary. Any discussion of treatment approaches or techniques is by necessity general and the private contractors have developed many of their own methods for solving the problems.

Disposal firms. Most disposal firms do not get directly involved with spill clean-up, however the various residuals may be detoxified at their facilities, prior to final disposal. Some groups have expanded to include an associated spill response section, but this is not common. The disposal firms contacted are mainly those associated with special handling of hazardous wastes. The types of wastes handled and the general capabilities vary with each installation. Most sites do provide various physical, chemical and biological treatment processes to concentrate or detoxify the wastes. The actual use of these facilities is determined by waste specific treatability testing. The use of published information sources is limited because of the extremely variable nature of most waste materials.

Although disposal firms may not have direct on site input to a spill response, their availability and capabilities are important when assessing the most cost-effective approach to spill handling. One of the viable options for spill mitigation is hauling to a treatment/disposal site. In order to properly evaluate this potential solution, an OSC should be aware of the private companies involved in this business.

TABLE 9. PRIVATE CLEAN-UP AND DISPOSAL FIRMS REVIEWED FOR THIS STUDY

### Spill Clean-up

1. Jet-Line Services, Inc.
441-B Canton St.
Stoughton, MA 02072
617/843-2824

2. Western Environmental Services
N. Portsmouth Avenue
Portland, OR 97203
503/285-9111

3. EMSERV
2000 West Loop South
Suite 1800
Houston, TX 77027
713/623-0000

4. O.H. Materials, Inc.
Box 1022
Findlay, OH 45840
419/423-3526

5. Marine Pollution Control
8631 West Jefferson Avenue
Detroit, MI 48209
313/849-2333

6. Ryckman's Emergency Action & Consulting Team
689 Craig Rd., Box 27310
St. Louis, MO 63141
314/569-0991

7. Ace Oil Corp.
876 Otter Creek Road
Oregon, Ohio 43616
419/726-1521

### Disposal

1. Newco Chemical Wastes Systems
4676 Royal Avenue
Niagara Falls, NY 14303
716/285-6944

2. Rollins Environmental Services, Inc.
One Rollins Plaza
Wilmington, DE
302/658-8541

3. Tricil Limited
606 Route B2
C.P. 59
Ville Ste - Catherine, Quebec
CANADA
JOL IEO
514/632-6640

4. Chem-trol Pollution Services, Inc.
Box 200
1550 Balmer Road
Model City, NY 14107

5. Ohio Liquid Disposal
804 Liberty St.
Freemont, OH 43420
419/547-7791

### Clean-up - Disposal

1. EMSERV
2000 West Loop South
Suite 1800
Houston, TX 77027
713/623-0000

2. IT Corporation
4575 Pachero Blvd.
Martinez, CA 94553
415/228-5100

### Other

1. Sealand Restorations, Inc.
Clayton, NY
315/686-4220

2. Rad Services
Pittsburgh, PA 15235
412/823-0810

3. IT Corporation, California
415/228-5100

# SECTION VI

# EVALUATION OF RESPONSE SYSTEMS

## General

The previous sections of the report have presented general summaries of various notification/reporting requirements, information sources, response manuals, and response teams which comprise a total response system for dealing with hazardous spill incidents. Although some discussion has been included in the summaries, the amount of environmental and public health protection offered by these systems has not been addressed. Of particular concern to this study is the degree of protection offered when a hazardous waste spill occurs. This section presents a general evaluation of these different systems with respect to the degree of environmental and public health protection from the dangers associated with hazardous waste spills. Because few of the reviewed systems actually address the specific problem of hazardous waste spills, it is necessary to provide a brief evaluation of the general spill response capabilities for the various systems. This review is intended only to aid in establishing the ability of a particular resource to respond to a hazardous waste spill and is not considered a thorough evaluation of various systems with respect to overall spill response. An effort of this magnitude is being performed elsewhere (1).

## Notification/Reporting Requirements

When considering notification and reporting requirements, the most critical aspect with regard to public and environmental protection involves notification. As presented in Section IV, these requirements do vary depending upon both the applicable Federal law and State regulations.

Among the important considerations associated with notification procedures are 1) what is the number of calls required for proper notification of all concerned, 2) how widespread is the knowledge of who to call, 3) what is the length of time between a call and the receipt of some technical assistance and 4) can an uninitiated person properly report a spill.

Calls Required for Notification. The number and type of calls required for proper notification will depend upon the applicable Federal and State laws. If a hazardous substance listed under section 311 of the Clean Water Act (CWA) is spilled, the Regional Response Center (RRC) and appropriate EPA and USCG authorities must be contacted. Since many of these substances are also DOT hazardous materials, DOT may have to be informed. When other legislation is invoked, then different agencies must be contacted. See Table 3.

State notification procedures vary considerably. In some states, there is a central 24 hour telephone number to call and at that point the responsibility for notification is met. In other instances, district spill control personnel must be contacted from a call list. If one person is not at home, the calls are to continue until someone is notified. Since the requirements vary from State to State, it is important that the potential spiller be aware of the various regulations and associated responsibilities, and then update their in-house listing periodically. It is important to note that many of the State laws already in effect can be considered to cover hazardous waste spills, so proper notification may already be mandatory.

*Widespread Knowledge of Contact*. The knowledge of who should be contacted may not be well known to spillers or others who may be affected by a spill. Federal and regional notification requirements are outlined in the various contingency plans, however telephone numbers and personnel may change without all users being aware of the situation.

States may make a concerted effort to distribute a call number or list to various industries and to emergency personnel. Research indicated that often the emergency personnel, such as State police, perform the actual State notification since they generally know who to contact. Some states have considered this and have allowed notification of the State police as an acceptable procedure.

*Response Time*. When a spiller is faced with an emergency situation, obtaining fast response information may be critical to reducing environment damage and eliminating a potential safety hazard. Often 24 hour telephone numbers are actually answering services where an operator or duty officer takes down the critical information including name of caller and a call-back number. The operator then contacts appropriate State personnel who are designated to respond to emergency situations. This contact may be slow, especially in off duty hours, since a home call list is common and people may not be specifically designated as "on call". The return call to the spiller may provide some of the needed emergency information, however it may not be quickly available.

*Uninitiated Personnel Involvement*. Notification of a spill incident may be performed by people with a wide variety of background knowledge and training. Persons reporting a spill occurrence could be those involved in the incident, (truck driver, motorists), witnesses or emergency response personnel. Their protection is critical through the response period.

*General Evaluation of Notification Procedures*. From the previous discussion, it can be seen that there are several aspects of notification procedures which are desirable and others which are not. One of the aspects which appears to cause conflict involves the use of a 24 hour answering service or a call list. The 24 hour number allows a spiller to make initial contact quickly and remove further notification obligations, at least at that level. However, critical initial response information may not be immediately available from this source and since the spiller must keep the telephone line free for a return call, it may not be possible to contact another source. Conversely, if a spiller must notify people through a call list, the time involved in notification may become excessive although the spiller should get some technical advice immediately after notification of response personnel. On a State level, this appears to pose a serious dilemna. Manning a 24 hour telephone with experienced response personnel is generally not possible due to manpower and budget limitations. This service could be supplied on a national or regional basis with joint Federal and State efforts.

Other important considerations include the distribution of appropriate notification telephone numbers. There may be some difficulties with regard to informing hazardous waste spillers of their legal obligations to notify authorities of a spill incident. Since many of the haulers may not be familiar with this type of responsibility, a single telephone contact is simpler, does not require much prior training and would be easier to distribute.

Reporting Requirements Evaluation. Reporting a spill incident is often required by law. The primary emphasis of this spill report is usually to provide documentation of the spill and generally includes the following: 1) a description of the situation and of the incident's cause, 2) a discussion of the response action taken, 3) an evaluation of the effectiveness of the response and 4) recommendations. The report may be required of either the spiller or the OSC at the site or both. DOT requires reports for all transportation related incidents, however, state and other federal reports may not be mandatory. As a result, records of spills may be incomplete and proper corrective actions not implemented. Consistency in both format and requirements is desirable when reports are evaluated.

## Information Sources and Response Manual Evaluation

Evaluation of different information sources and response manuals is extremely difficult since each individual reference or source has been developed to meet certain specific objectives. Usually these objectives are met quite well and comparison to other sources is not possible because of differences in scope. This evaluation has been developed to highlight various systems' usefulness when a hazardous waste spill occurs. First telephone contact sources are briefly evaluated and the results are discussed. Then written information sources and response manuals are considered. This evaluation is quite extensive and involves both a general evaluation of the system output as well as consideration of its applicability to hazardous wastes.

A general evaluation format has been included and the advantages of various manuals are stressed. Emphasis has been placed on considering information outputs which protect the human health and the environment. Other important considerations have involved the type of audience addressed, the clarity and general readability of the manual, its availability and its bulkiness. In addition, the degree to which the manual met its stated objectives is evaluated.

After the general evaluation is completed, then the most acceptable sources are investigated for their applicability to treating hazardous waste streams. Defined streams have been identified (33,34) and are considered in this evaluation. From this information, the applicability of various manuals to hazardous waste spills can be defined and missing information can be identified.

Evaluation of Telephone Response Sources. Several important considerations are involved when reviewing telephone response sources. These include:

1. Availability of computerized data
2. Access and response time
3. Degree of input required
4. Variety of chemicals addressed
5. Type of output available

The seven different telephone information sources addressed in Section IV can be evaluated considering these capabilities.

Availability of Computerized Data Base. Computer systems are generally desirable since they allow storage of a wide variety of data, are searchable (in case the material is not identified) and have a fast turnaround time. However only OHM-TADS contains extensive computerized information directed to spill response. Lockheed Information Systems is limited to identification of background data sources and the Missouri Pacific Railroad System is designed for use mainly in train derailments and has less general accessibility. Other telephone sources consist of card files which are accessed by a trained operator. Information available is generally limited to some initial response input and possibly the manufacturer's identity.

Access and Response Time. Access is quite critical since a spiller may require information quickly and efficiently. As a result, a 24 hour telephone contact is important. CHEMTREC and TEAP have this capability. It is extended to CHLOREP and IRAP since they are contacted through CHEMTREC. Initial information can be immediately transmitted during the first phone conversation so the reporter can take proper actions at the spill scene. Another important aspect is who can access the system. A general number available to anyone who needs assistance appears best. Again, CHEMTREC and TEAP offer this service, although OHM-TADS unfortunately does not. OHM-TADS is not accessible on a 24 hour/day basis nor is it available to the general public. Many state agencies do not have direct access to OHM-TADS although it is usually available at the RRC. Lockheed Systems are accessed when the computer is up and the Missouri System can be used when needed by the proper officials.

Degree of Input Required. One of the most important concerns when evaluating an information system is the amount of input data required to access the data. Most sources require prior knowledge of the identity of the spilled material before an output is available. When it is necessary that the material be identified by its generic or trade name, this can be a serious limitation when controlling mystery spills, unidentified pure chemicals and especially mixtures of hazardous wastes. Unless the components of a hazardous waste are known or unless the waste is a relatively pure material (ie. spoiled batch, waste chemicals), most of the information systems cannot be accessed.

The only source which allows identification of chemicals through a search technique is OHM-TADS. However, OHM-TADS is limited to identification of pure compounds, so has additional limitations when mixtures, especially wastes, are considered.

Variety of Chemicals Addressed. The type and number of hazardous materials addressed is crucial for long term evaluation. Most systems address only pure chemicals and OHM-TADS does mention binary mixtures but does not present details. Hazardous wastes are included only if they are spoiled batches, contaminated process chemicals or other relatively pure materials. Therefore, general applicability of these sources to hazardous waste is limited.

The number of chemicals addressed is also important. The more chemicals included, the better are the chances of getting the needed output. This holds true for hazardous wastes and pure chemical spills. Establishing how many chemicals and which ones to include is difficult. CHEMTREC provides the greatest number of materials (3,600 virgin chemicals) and has been criticized by spill response personnel for not having needed data when required. When hazardous wastes are evaluated, the problem becomes even more complex. Mixtures can be comprised of many components in different amounts which could result in extremely variable combinations in hazardous wastes. Accessing information for a given mixture would be extremely difficult.

Type of Output Available. Outputs available from these sources range from a listing of abstracts to a comprehensive compilation of pertinent spill response data. Human health protection information (toxicity, flammability and explosion hazards, first aid procedures, safety equipment) is available to different extents from the sources. Environmental impact and protection data is available from OHM-TADS and may be identified through the computer search of abstracts. Initial response and control procedures are not usually included in these sources. OHM-TADS is an exception but it requires previous knowledges of the format and data base for most effective use.

Lockheed and other information retrieval systems can provide only abstracts for review. These abstracts may identify pertinent additional information but obtaining these sources may be difficult. TEAP and CHEMTREC generally provide general human health information and the name of a manufacturer who can give further technical inputs to response personnel.

Summary of Telephone Contact Organization Evaluation. In summary, none of these sources addressed hazardous waste materials or their spillage. When identified, relatively pure hazardous wastes are involved, the information included in these sources may be applicable. OHM-TADS presents limited accessibility and the output may require technical interpretation. Although CHEMTREC and TEAP do not provide the comprehensive amount of information but are readily accessed and provide output immediately. They also indicate the name of a manufacturer for further contacts or perform the actual contact. IRAP and CHLOREP provide valuable information but are limited to specific product expertise. Lockheed's output is not directly applicable to spill response and access may be limited.

Environmental impact and human health information are presented in various degrees of detail. Most offer direct first aid and safety procedures for those people first on the site of the spill. OHM-TADS includes toxicity information and environmental impact data in detail.

General Evaluation of Written Manual Output. A basic evaluation format was developed which allowed a simple determination of the available outputs from the various written manuals and information sources. Three different ratings will be applied: 0, 1 or 2. A zero (0) rating indicated that the subject was not addressed or covered at all in the manual. A one (1) rating meant that the information was mentioned without extensive details or that the data was sometimes or somewhat available. A two (2) rating indicated yes, always or that detailed information was included for those specific evaluation categories. The manuals were rated somewhat subjectively however, the approach allowed a general comparison between sources. This approach was consistent between manuals which was considered critical for effective overall evaluation.

The following paragraphs discuss the various categories included in the evaluation and summarize the results obtained. Manuals with certain strengths in various areas have been highlighted in the discussion, otherwise the presentation is somewhat general. The reader is encouraged to refer to the completed evaluation forms (Tables 10-13) for detailed information on a given response manual.

Materials Addressed. (Table 10) This classification involved an evaluation of materials which were addressed by the different written manuals. Five different subjects were considered applicable.

The first three discuss how and what materials are addressed in the manual. The manuals either addressed the specific compound directly, an approach which usually required an alphabetical listing of all chemicals addressed or addressed the potential hazards as part of a broad generic classification of materials.

Other subjects in this category considered whether or not mixtures and/or hazardous wastes were mentioned in the manual, whether properties of the chemicals including melting and boiling point, physical states, vapor pressure etc., were considered and whether chemical interactions with air, water, or other chemicals were addressed.

The most common approach was identification of individual pure chemical- from which additional information was accessed. This procedure was used in approximately 75% of the sources investigated. The other method to address chemicals was to classify them according to hazard or DOT placard type. This technique was prevalent for training manuals or guides or for brief manuals which presented only the most crucial first response information.

Hazardous wastes specifically were addressed in only one source, the Redland Purle Tremcards, and a general discussion of wastes was presented in the TRW report on Reduction, Neutralization Recovery and Disposal of Hazardous Waste. Most manuals mentioned mixtures, but only five actually addressed the problem. Even when the mixtures were considered it was not with the frequency or detail associated with pure or virgin materials.

Properties specific to chemical type were presented to varying degrees. CHRIS Vol. 2 and OHM-TADS include a very thorough description of chemical properties that would be important in a spill incident. Several firefighters' guides including the Fire Codes and NFPA Guides, Fire Officer's Guide and the Chemistry of Hazardous Materials presented and discussed pertinent properties as relating to initial response. General information which may also be applied was available in the Merck Index and the Individual Chemical Data Sheets. Property changes were mainly addressed in relation to firefighting, and most sources written for these people addressed problems such as reactions with water or potentially explosive mixtures. The specific Chemical Data Sheets also presented information regarding property changes.

Immediate Action Presented (Table 10). The next evaluation category involved determination of how the different manuals addressed the crucial immediate actions needed at the scene of the incident. The data can be roughly grouped into actions which either protect human health or offer environmental protection. Human health concern is apparent in subjects relating to safety hazards, evacuation procedures, and first aid. Environmental impacts are more affected by containment and notification techniques. The other categories present aspects of both concerns.

One of the first considerations was whether or not containment techniques (ie. procedures to control the discharge) was included. Then the inclusion of notification requirements to local, State or Federal agencies was considered as an important aspect of immediate action. Inclusion of this type of information involves presenting necessary telephone numbers and/or information regarding how to obtain them. Another critical aspect of initial response involves establishing both the distance and direction of evacuation when necessary. Potential safety hazards associated with initial response should be addressed since there are certain hazards which are involved when containment or evacuation procedures are implemented. Discussion of firefighting techniques basically involved determination of what approaches should be used to contain a fire emergency safely and effectively. Information sources refer to the manuals' inclusion of referenced information sources, either quick response or written, which will allow the user to obtain more detailed data on the potential hazards and control techniques. First aid procedures are also considered a part of initial response since unintentional exposures could have occurred which may require immediate treatment at or near the spill site.

Detailed information regarding containment procedures was not presented in many of the sources. CHRIS had a good section and the EPA Manual for Control of Hazardous Material Spills also had some information on containment. Some general mention of containment, such as "build dikes to contain flow" was included in selected manuals which highlighted initial response. Notification procedures were detailed in NFPA/DOT training manual, the EPA Manual, Chem-cards and the AAR Manual-Emergency Handling of Hazardous Materials in Surface Transportation. Some sources did mention that proper notification should be performed. Detailed summaries of notification requirements were not included in any source, although at times the appropriate contingency plan was referenced.

The potential safety hazards and appropriate precautions to take were then evaluated. Some of the specific safety problems associated with the initial response were considered. These hazards were most clearly presented in the various texts directed to firefighters, in the AAR Manual, in CHRIS and both the Chem-cards and Chemical Safety Data Sheets. Other sources mentioned that various initial response procedures could be dangerous, and proper precautions should be taken although detailed instructions were absent.

Evacuation procedures were not frequently mentioned in the reviewed sources. CHRIS presented detailed methods for calculating affected areas and then recommended appropriate action, however this approach may not be considered an initial response. The DOT Manual - Hazardous Materials Emergency Action Guide - graphically depicts the evacuation area as a function of wind velocity. This approach is clear and simple to use for uninitiated personnel at a spill site. Other manuals directed to firefighters indicate that proper evacuation should be undertaken and some give definitive directions.

Firefighting information is presented in most detail in those sources directed to the firefighters themselves. Specific detailed information by chemical is found in the National Fire Codes - Volume 3. Sax's Dangerous Properties of Industrial Chemicals also provides necessary information as does the AAR Manual. Other good sources of firefighting techniques are tabulated in the Chem-Cards and the Chemical Safety Data Sheets. Tremcards address firefighting methods for involving hazardous wastes.

Reference to other sources was also considered important when initial response was involved. CHEMTREC was the most common source indicated and the referral number was presented in most of the immediate response manuals. A brief review of information sources was included in the EPA Manual, and CHRIS suggested some sources of additional input. The DOT/NFPA training manual presented a unit on the available information sources.

Finally, first aid techniques were considered. Many of the immediate response manuals mentioned the appropriate first aid techniques by specific material addressed. Among those which contained useful first aid procedures were Vol. 1 of CHRIS, DOT Emergency Action Guide, the AAR Manual, OHM-TADS, some NFPA Guides, Guide for Handling Hazardous Materials, the Industrial Safety Manual and Chem-cards and the Chemical Safety Data Sheets. Tremcards presented first aid procedures to be taken in the event of a hazardous waste spill.

In general, the most complete and applicable initial response information was provided in those manuals which considered immediate response the prime objective. Several background manuals were directed to firefighters but still included detailed initial response information. The difference was that these sources tended to address chemicals by classification rather than by individual identity. The details regarding initial response varied significantly from one source to another. It appears that containment techniques and notification procedures received the least amount of elaboration. Firefighting and first aid procedures were generally given the most emphasis. This condition reflects the major concern with human health protection during the initial stages of spill response.

Identification Procedures. (Table 11) One of the most critical aspects of spill response evolves around knowing the identity of a material which has been spilled. As indicated previously, most manuals address the substances by compound or tradename. Some present information by DOT placard type or general classification, but even in these situations, the person first on the scene must have access to these markings.

This category attempts to determine how many manuals address the problems associated with identification and to what degree. Methods to identify materials through the use of DOT placards/labels, bills of lading or tracing of the shipper from the car/truck number are considered first.

Physical/chemical property methods for identification are also considered as a subject heading as well as methods for identification of unknowns through laboratory testing. The potential safety hazards associated with attempted identification is another important consideration (ie. how safe is it to walk up to a leaking drum to inspect a label, etc.). The amount of material spilled or spilling can also be an important consideration since the magnitude of the hazard can be established by this information. There are various techniques which can be used to estimate the volume spilled. Sometimes these were outlined in the response manual.

Identification of mixtures or hazardous wastes can be even more difficult than identification of pure compounds. If procedures were included to provide this type of identification, this was noted.

Unfortunately, complete techniques regarding methods available to identify a specific material are not presented in any manual. The EPA manual includes detailed information regarding placarding, bills of lading and shipment tracing but does not detail identification techniques by other methods. The same general approach was used in the DOT/NFPA Training course in which a unit was devoted to identification by these techniques but no information was included regarding what to do if identification was still not accomplished. The NFPA guides presented a general identification approach using their diamond label and the AAR Manual included a numbering method by which specific materials were assigned a code to illustrate their hazards. This code would be available on the bill of lading. In other sources, methods to identify the material or at least the imminent hazards were presented but not discussed in detail.

Identification by physical properties was presented in detail in the EPA's Damage Assessment Manual. In this text, various noticeable physical properties were delineated from which the possible identity of the substance could be determined. OHM-TADS offers a similar computerized search function. Laboratory evaluation was only briefly mentioned.

The actual safety hazards associated with determining identification were not often stressed. Some sources mentioned the potential danger associated with approaching an unknown product but often this hazard was not emphasized. One suggested treating the material as extremely hazardous until the identity was known. This approach will safeguard human health as much as possible.

Methods to estimate the volume of material spilled were presented in detail in CHRIS and mentioned in other sources. The importance of knowing this information becomes apparent in establishing the overall degree of hazard.

When identification for hazardous wastes or mixtures was considered, there was no information available. The Tremcard labeling approach could be applied to provide a preliminary identification of the waste stream but a detailed evaluation would not be possible using information from this or any other source.

Spill Danger Assessment. (Table 11) This category involves determining the extent of human danger resulting from a spill. First the affected area must be calculated from various on scene inputs. One of the most critical aspects of this evaluation will be to determine the impact of weather on a specific situation. Sampling to allow preliminary problem identification or confirm the assessment could be important along with input with respect to population patterns or the number of people affected.

Only three of the sources reviewed actually addressed this subject in detail. CHRIS - Volume 3 has been dedicated to assessing the impact of a spill and associated hazards to various populations. CHRIS includes various computerized calculations to estimate plume or cloud travel, flammability hazard distances, and many other variables. None of the other sources address this subject in as much detail.

The EPA Manual for Control of Hazardous Spills mentions assessment techniques but refers to CHRIS for the needed detailed input. The DOT Guide considers wind direction and speed as well as populations when evaluating evacuation procedures. CHRIS is the outstanding reference for this type of information. However, a problem could be associated with a lengthy response time, since the results may not be available until after the hazard has passed. Another problem with CHRIS for hazardous waste instances is its requirement of pure chemical input and its basic limitations to air and water spill situations. The information may be applicable to land spills but it is not presented in that manner.

Hazard and Environmental Impact. (Table 12) The specific ways in which the manuals address human and environmental hazards are evaluated in this section. Toxicity or health effects are considered for animals and humans. Where there is a differentiation for inhalation impacts or dermal effects this has been noted. Aquatic toxicity values are most commonly available have been included separately from the other considerations. Their direct value to spill response is slight. Impact on vegetation as well as general hazards (flammability, explosiveness, corrosivity) are considered as important outputs. Potential water supply threats (surface or ground water) and air pollution threats are also addressed in this evaluation.

This section also considers damage assessment which involves sampling after the spill occurrence to establish the amount of environmental damage which occurred prior to establishing penalties.

Toxicity information is available in varying degrees throughout the information sources. CHRIS - Vol. 2 and OHM-TADS appear to offer the most comprehensive information with regard to almost all types of toxicity hazards. The Chemical Safety Data Sheets also provide a significant amount of data on toxicity. However, much of this data is technically oriented and presented in quantitative terms. As a result, it may require interpretation by trained personnel before being useful.

Other sources provide selected data regarding toxicity. The MERCK

Index discusses human toxicity as well as skin irritation and inhalation effects while the Toxic and Hazardous Industrial Safety Handbook addresses human and animal toxicity and presents flammability hazards. Sax's Dangerous Properties volume mentions most hazards with respect to human health and flammability.

Several of the immediate response sources provide abbreviated hazard information directed to the person at the scene of an incident. In this approach, direct mention of the hazard is included often with associated remedial action. Examples are in CHRIS - Volume 1, Chemcards, the DOT Guide, the AAR Manual, the Fire Codes and some of the texts directed to firefighters.

Hazards to vegetation are generally not discussed, although they are mentioned in the EPA's Damage Assessment Manual. Threats to water supplies are sometimes mentioned but are usually not detailed. Finally, methods for spill assessment are not included in any detail except in the EPA Field Detection and Damage Assessment Manual for Oil and Hazardous Materials.

Containment Methods. (Table 12) This section considers the detailed aspects of containment and is intended to evaluate the "how to" instructions which may be presented in various manuals. Containment for air, land and water (surface and ground) spills is considered separately. Then the safety hazards associated with implementing containment are considered. This includes proximity of personnel to spills for effective containment, etc. Procedural details involve both establishing the location of proper containment devices and determining how to locate them.

Containment techniques do not appear to be presented in any depth. Some detailed information is presented in the EPA Manual for Control of Hazardous Spills and CHRIS - Vol. 4, however, neither are all encompassing. Sax's Dangerous Properties of Industrial Chemicals also addresses containment techniques for land and water spills. Other sources mention that diking or diversion should be attempted but include no further details.

One important consideration is the safety hazard associated with containment. Few sources consider this problem. Some of the manuals directed to firefighters provide part of this information but usually not for specific materials. Other sources mention that care should be taken when performing these tasks but few emphasize this warning.

Containment of water spills is most commonly addressed, although some information is available on containment of land spills. Hazardous waste spill containment methods are not directly considered, although it may not be possible to address them separately.

Specific discussions of containment techniques to be utilized are difficult since the actual approach to containment is both site and material specific. The same is true of associated health hazards. However, a description of possible procedures alone with various advantages and disadvantages will allow the user to know what techniques are available.

Clean-up Procedure. (Table 13) The actual clean-up is addressed in many ways by different manuals. For the manual to be most useful, detailed procedures must be presented either specific to substance or to some dominant hazardous characteristic of a given mixture. It is also desirable to present other handling alternatives, along with a situation specific method for evaluating which procedure is most appropriate to a given circumstance.

Detailed clean-up implementation instructions will also be necessary. These may involve end-point specification, testing procedures, etc. The associated difficulties with clean-up should also be addressed, as well as necessary safety precautions needed when implementing the treatment methods.

If possible, discharge standards (how clean is clean) should be established or a criterion presented. Applicable disposal methods for sludges, spent media or other residue should be presented. Finally, it must be determined if the information on clean-up is applicable to hazardous waste and if it can be accessed.

This type of information is not generally available either through a spill response manual or in other forms. The most valuable information in this regard is presented in the complete response manuals and some information is available in disposal manuals. The EPA Manual for Control of Hazardous Materials Spills includes the most information on this subject. It addresses treatment of approximately 300 different materials and includes detailed instructions regarding implementation in a field situation. This manual also presents a method to evaluate the various handling methods in order to specify an optimum approach. However, the techniques presented are generally limited to water spills.

OHM-TADS presents chemical specific information regarding the methods appropriate for "in-situ amelioration". However, detailed information regarding implementation or consideration of site specific variables is not included. CHRIS - Vol. 4 includes various response methods but they are not substance specific, rather they are method specific. They are also generally limited to clean-up in large water bodies. Details are somewhat limited regarding all phases of implementation. Some clean-up information can be inferred from the Fire Codes - Volume 3 or Tremcards, but it may be difficult to implement without additional technical input. Disposal manuals including MCA's Laboratory Disposal Methods, the TRW report and the UPS Chemical Disposal Techniques for Hazardous Chemicals include some critical information on chemical detoxification procedures but no details regarding their implementation.

Discharge standards are generally unavailable. Some sources include drinking water limitations for reference, however, it appears as though more research will be required to establish the degree of treatment necessary. Disposal techniques are mentioned but not frequently and without details.

Specific treatment of hazardous waste spills are not addressed at all, although some available information may be pertinent to hazardous waste materials which are pure, well identified compound. Access to all clean-up information requires prior knowledge of the identity of the material spilled.

Flexibility. (Table 13) This classification considered several criteria including whether the source addressed potential spills contaminating any of the three media including land, air or water. Other considerations were whether there were complete procedures for each and if the manuals could be accessed without knowledge of the specific material identity.

Background sources did not address this category at all. Most immediate response manuals were not limited with regard to media affected although they did not provide complete and detailed full response information. Complete response and disposal manuals varied in their limitations. CHRIS is limited to water and some air related incidents, while OHM-TADS addresses some aspects of all media. The EPA Manual considers all spill types but presents clean-up methods for only water spills. The UPS-Disposal Manual is directed toward land spills while the others are water related or not limited. The detail involved in the response is mainly a function of the objectives of the manual and its overall output.

The type of access could be divided into three types: those requiring knowledge of the specific identity of the material, those requiring knowledge of the DOT placard and those requiring knowledge of various physical properties. Most required knowledge of the identity. Two manuals could be accessed through the placard type and two more manuals could be utilized if various physical properties were known.

Summary of Written Manual Output Evaluation. The type and detail of the outputs associated with the written manuals varies with the individual source being evaluated. Different initial objectives had the greatest impact on the type and form of the output presented in each manual. The complete response manuals generally present the most information but are usually limited to spills affecting water. CHRIS appears to offer the most information regarding spills but is also most directed to incidents contaminating water bodies. Extrapolation of the information to land spills is difficult. The EPA Manual for Control of Hazardous Material Spills does address treatment but is limited to an on-site but offstream mode and does not consider land spills. Similar critiques can be made for all other sources. The most important determination is that no one manual presents detailed information [illegible] all categories and very few sources address the special problems of [illegible]dous waste spills.

General Evaluation of Manuals' Ease of Use. When considering a manual, the output is extremely important but it is also critical to know if the manual or source can be easily used. Evaluation of this quality is even more difficult than delineation of various outputs since the rating is actually the contractor's opinion. However, it is felt that this subject should be evaluated in order to properly assess the overall usefulness of the various manual. Therefore, four categories have been developed which will help establish a response manuals ease of use. These are: 1) audience addressed, 2) clarity, 3) requirements for prior training and 4) how well the manuals met their stated objectives. Ratings are either yes/no or excellent to poor, depending upon the categories. Since the ratings are subjective, the major attempt has been to keep them consistent among the manuals being considered. In this way, a basic comparison between sources is possible. Tables 10 and 11 include the resultant ratings and should be referred to during the following discussion.

Audience Addressed. (Table 14) The type of audience to which the source addressed itself was important since a wide variety of personnel could be involved in various aspects of spill response. Four general classifications were considered: general public; carriers (truck drivers, railroad employees, etc.); emergency response personnel (firemen or policemen); and highly trained technical personnel (scientists or engineers).

Review of the results showed that technical personnel were required when background information sources dealing with hazards were consulted or when a complete response manual was accessed. Most initial response resources were directed to carriers or emergency response personnel. Special texts written for firefighters were generally classified in this group. Disposal information generally required technical review before application.

Clarity. (Table 14) The clarity of the manual can be assessed through various criteria. In this evaluation, seven categories were considered. First it was determined whether a source highlighted important information. This usually involves the use of colors or bold face print to set off the subject. Another important consideration was whether or not a manual presented the data in a short and concise form and in a manner from which it could be applied quickly and effectively. Excessive repetition was undesirable and referral to other information sources to eliminate repetition was considered valuable. A subjective determination of the manuals' readability was made which considered the general format, size of print, difficulty to handle, etc. Finally, the size of the manual was mentioned since it was felt that extremely bulky books may be undesirable for field use.

This classification involved many different considerations and a final concensus with regard to clarity is difficult. Most manuals used some method of highlighting their instructions although the Merck Index and OHM-TADS were notable exceptions. The qualities of short and concise seemed to be somewhat a function of the objectives of the manuals. Texts were not short nor were most complete response manuals, however many of the resources directed toward immediate response had short, concise entries designed to convey critical information to the unihibited user. A similar trend was noted when evaluating the sources' content for ability to be applied quickly and effectively. Immediate response manuals were best in this category. Especially noteworthy were CHRIS - Volume 1, Chemcards, Tremcards and the DOT Guidelines.

Most sources had little repetition and referred to outside sources to some degree. References or inclusion of the CHEMTREC number were most common. Readability was difficult to assess but basically seemed related to the other variables, size and objectives of the manual. Most readable seemed to be immediate response manuals or sheets, most difficult were the complete response manuals. Size did vary from the size of a roadmap or small book to 16 volumes. The apparent correlation for field use is the smaller the better.

Requirements for Prior Training. (Table 15) The types of training required could be divided into four different types: mandatory technical training (longer than a 3 day course, probably 2 weeks minimum); short course (1-3 day training course); orientation (generally a short, less than four hour, description of the contents) or self-explanatory (no training required). The ratings were subjective but should allow comparison of the various sources. In some instances, a higher level of training was considered desirable but not mandatory for effective use of the manual, and this was indicated.

The lowest level of training was required by the immediate response manuals, especially Chemcards, Tremcards, the DOT Guide, the Guidelines for Handling Hazardous Materials, and the AAR Manual. Some orientation may be desirable but these sources are generally quite useful without special training.

Background information source requirements varied as did those for immediate response systems directed to firefighters. Technical background was needed for use of those sources presenting detailed toxicity and hazard data. It was considered desirable for people to have at least a short course when utilizing some of the firefighter's background texts. The Fire Codes themselves included a significant amount of information so that at least an orientation course would be desirable for their most effective use.

For the Complete Response Manuals, the required level of training varies. CHRIS - Volume 1 can be used without training, while Volume 2 requires some explanation, and Volumes 3 and 4 definitely need technical training. (This fact has been recognized by the USCG who provide various training courses in the use of the CHRIS Manuals). OHM-TADS definitely requires interpretation by technically trained people who should be aware of both the available data and its limitations. The EPA Manual can be used with a short course training period but a technical training course is desirable to use the information effectively.

The EPA Detection and Damage Assessment Manual can be used with only a brief orientation, however, a short course would be desirable and technical training may be needed if personnel do not have sampling expertise. Both the UPS and MCA disposal manuals would require only some initial orientation, while the TRW report needs technical training background or a college degree in science or engineering.

Ability to Meet Objectives. (Table 15) This category subjectively rates the way a source met its stated objectives. It can be seen that almost all manuals met the objectives well. Sax's Dangerous Properties of Industrial Chemicals was difficult to use and therefore did not meet one of its stated objectives. Both the DOT Hazardous Materials Emergency Action Guide and the EPA Field Detection and Damage Assessment Manual were outstanding in meeting stated objectives. They both addressed different topics of relatively limited scope, but presented a large amount of information in a clear, useable manner.

Ease of Use Evaluation. A brief review of this evaluation procedure indicates that, in general, the immediate response manuals were easiest to use. They generally addressed a broad audience, presented information clearly, were applicable to a large variety of situations and required little prior training. All other types of manuals were much more difficult to utilize from all aspects. Especially difficult were the complete response manuals (CHRIS, OHMTADS, and the EPA Manual). The CHRIS - Vol. 1 manual is easy to use but the other volumes require previous orientation and training. OHM-TADS also requires background knowledge for most effective use. The EPA manual is complex since it covers a large variety of subjects. The first few chapters may be useful to relatively uninitiated personnel with guidance, however, other sections on treatment processes and construction are definitely addressed to trained technical personnel.

Applicability to Hazardous Waste Streams. The major objective of this project was to review the response systems overall applicability to hazardous waste spill incidents. Since the definition of hazardous waste has not been firmly established, this type of evaluation was difficult. Information was available which defined waste streams and the associated hazardous components for seventeen industrial types. A listing of these streams is presented in Appendix B.

Review of the waste streams indicates that there are innumerable combinations of hazardous materials which may be involved in a spill incident. The specific components of waste streams may not be known and therefore cause severe problems for accessing information available in response manuals. Typical waste streams can be as simple as a spoiled batch or spent chemical or as complex as a mixture of solvents, and inorganic metal salts. Although the components of hazardous waste streams have been defined to a certain extent as shown in Table B-1, the number and combination of these components as well as some of their interaction products remain undefined and possibly undefinable. As a result, it is extremely difficult to determine which of the different waste streams will be addressed by existing information sources or response manuals. Another problem involves the form of the given waste stream. Most sources have information available on materials in their virgin form, not as sludge, slurries or other mixtures. The information available may not be applicable if the form of the material has been changed during processing.

It is possible to generalize regarding the applicability of response systems to hazardous waste spills. When spoiled batches or spent chemicals of known identity are involved in a spill incident, then the existing response manuals and information sources could be utilized. When chemically similar materials are identified, the existing systems could also be helpful. Problems occur when the hazardous waste is a mixture of undefined materials. In this instance; most available identification techniques established for pure chemicals, are not applicable. Without knowledge of the specific identity, any response is severely hampered since few sources can be accessed.

Even when the identities of the components in the hazardous waste stream are known, care must be taken to consider the impact of inert constituents as well as interaction of the hazardous components. Problems could be severe when treatment schemes are applied without taking these factors into account. A plating or paint waste stream provides an example of the potential problems. This waste stream can contain cyanide and chromates which are treated using dissimilar approaches. Cyanide requires oxidation while chromates are usually reduced prior to precipitation. Application of a single treatment technique or the wrong order of procedures could be dangerous since hydrogen cyanide may be evolved at the low pH required for chrome reduction. This example highlights the problem that even when the identities of the waste components or by products are known, available information for pure chemicals may not be directly applicable. Therefore, the fact that technology is developed to handle individual waste stream components does not necessarily mean that enough information exists for overall waste stream treatment.

Table B-2 includes an evaluation as to whether the hazardous waste stream components are addressed by the three complete response manuals

(OHM-TADS, CHRIS and the EPA Manual for Control of Hazardous Material Spills - Volume 1). Many of the components in their pure state are addressed by one of the manuals. However, there are quite a few organic chemicals or organo metallic compounds which are not included. Another problem which became apparent was the manner in which the hazardous compounds were specified. Many of the components were addressed in general categories such as solvents, chlorinated hydrocarbons or organic chlorides. Elemental metals and certain metal compounds are also not covered.

Evaluation by User's Comments. The final method of evaluation of manuals and response sources had been intended as a thorough discussion of user's comments. However, it was found that most state spill response personnel did not use the available manuals and that the federal coordinators had varying opinions on individual sources.

State response personnel usually contacted the manufacturer directly to obtain the needed technical input. They obtained identification of the manufacturer directly from the shipping paper or possibly by contacting CHEMTREC. The manufacturer was then called through an emergency telephone number usually available from the city police department. State and some federal personnel were generally satisfied with this approach.

Another approach used by state personnel was to coordinate in-house technical resources, both personnel and library, and develop a feasible approach for spill mitigation. This procedure was also considered basically successful by those using it.

It was apparent that state spill personnel had only minimal contact with various manuals, if they were aware of their existance at all. Therefore their input with respect to evaluation was slight.

Federal OSC's had differing opinions regarding the usefulness of information sources and manuals. In general, they were more familiar with available sources and had utilized the output. Both OHM-TADS and CHEMTREC were commonly mentioned with some OSC's liking them and others disliking them. The CHRIS system was not as useful to EPA personnel since it was basically directed to spills in large water bodies. The EPA Field Detection and Damage Assessment Manual was usually considered a good source for its purpose. Since the OSC's had different technical backgrounds and experience and since they interpreted their own roles differently, a consensus of opinion was not achieved.

## Response Team Evaluation

The various response teams have different capabilities and objectives, similar to the manuals. However, due to the extreme diversity of the groups involved and the rapidly changing state-of-the-art, it is difficult, if not impossible to perform an indepth evaluation of their capabilities. Instead, the various groups were considered with regard to their applicability to clean-up of hazardous waste spills, their general accessibility to a spiller, and the type of response advisory of actual clean-up which they performed.

Summary of Teams. Those groups which are accessed through CHEMTREC or who may be available at the request of the OSC are listed in Table 16 along with a general summary of their capabilities. Specific private contractors have not been included since complete information was not available for all groups and since the capabilities for most are rapidly expanding. For an up-to-date review for a specific contractor, the reader is encouraged to contact them directly.

It must be reemphasized that the listing of response organizations is not all inclusive. An attempt was made to include all pertinent groups or firms, however, due to the rapidly changing nature of the field itself, it is anticipated that some groups could have been inadvertently omitted.

Government Sponsored Groups. Most government sponsored groups are limited to handling only specific types of chemicals. The United States Army Chemical Response Team is basically limited to military type chemicals and IRAP is involved only with radiation incidents. The Coast Guard Strike Teams have, to date, not responded to many spills of hazardous chemicals and when they do get involved, they are limited to those types and locations listed in CWA - Section 311. The same general approach holds for members of the Regional and National Response Teams since their formation was mandated under the CWA and is also limited to the listed 271 chemicals.

Location of spills must also be considered. The MRT, RRT, and Strike Teams are limited to spills in navigable or coastal waters. Since many hazardous waste spills are anticipated to occur on land, these response groups would not be required to be dispatched. A final problem with these groups involves the type of response offered. In most instances, they are advisory (with the exception of the Strike Team). As a result a third party contractor or other industry representative must still be on the scene to perform the actual clean-up.

Industrial Associations. These groups are limited in their capabilities to respond to hazardous waste spills. Unless relatively pure "spoiled" batches are spilled or the specific chemicals can be identified, the Pesticide Safety Team (PST) may not be utilized. CHLOREP would have little applicability when dealing with hazardous waste spills. In-house industrial response groups may become involved with hazardous waste incidents as needed, although they may not have more detailed information when a waste is the spilled material.

Accessibility is good for both CHLOREP and the Pesticides Safety Team, since they are contacted through CHEMTREC.

Private Contractor Services. The private contractors probably have the most flexibility when spills of hazardous wastes are considered. If the contractor has a laboratory facility available, effective treatment schemes may be developed. General equipment such as excavation machinery, tanks, pumps, etc. are helpful when handling a wide variety of spills including hazardous wastes. Some chemical treatment capability is necessary and contacts with acceptable disposal facilities are desirable. Accessibility does not appear to be a problem since most clean-up contractors have 24 hour telephone numbers available. Depending on their availability, response time can be quite short. Finally, a main advantage of a third party clean-up contractor is that they will actually perform the clean-up. Depending on the situation, they may offer technical input or be directed by the OSC, but in all instances they are equipped to do the necessary work on the site.

TABLE 10. EVALUATION OF RESPONSE SOURCES FOR MATERIALS ADDRESSED AND IMMEDIATE ACTION PROCEDURE.

| LEGEND<br>2 - detailed, yes, most<br>1 - mentioned<br>0 - not mentioned<br>not applicable, no, least | Dangerous Properties of Industrial Materials edited by N. Irving Sax | The Merck Index edited by M. Windholz | Toxic and Hazardous Industrial Chemical Safety Manual - The Int. Technical Info. Institute | Chemical Safety Data Sheet - MCA | Chemistry of Hazardous Materials - E. Meyer | Fire Officers Guide to Dangerous Chemicals- -L. W. Bahme | Hazardous Materials Schiele and Pauze |
|---|---|---|---|---|---|---|---|
| Materials addressed | | | | | | | |
| - Pure | 2 | 2 | 2 | 2 | 1 | 0 | 2 |
| - Categories | 1 | 0 | 0 | 0 | 2 | 2 | 2 |
| - Mixtures/Wastes | 2 | 0 | 0 | 1 | 0 | 2 | 0 |
| - Properties Discussed | 1 | 2 | 0 | 2 | 2 | 2 | 1 |
| - Property Changes | 1 | 0 | 0 | 2 | 2 | 2 | 1 |
| Immediate Action Presented | | | | | | | |
| - Containment | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| - Notification Procedures | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| - Safety Hazards | 1 | 0 | 0 | 2 | 2 | 2 | 1 |
| - Evacuation Procedures | 1 | 0 | 0 | 1 | 0 | 2 | 2 |
| - Fire Fighting Information | 2 | 0 | 1 | 2 | 2 | 2 | 2 |
| - Information Sources | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| - First Aid | 1 | 0 | 2 | 2 | 0 | 0 | 0 |

TABLE 10. (continued)

| LEGEND<br>2 - detailed, yes, most<br>1 - mentioned<br>0 - not mentioned<br>not applicable, no, least | Emergency Handling of Hazardous Materials in Surface Transportation - Bureau of Explosives-A.A.R. | Guidelines to the Handling of Hazardous Materials D. J. Behrendsen | Hazardous Materials Handbook - J. H. Meidl | Hazardous Materials Safety Manual - State of Minnesota | National Fire Codes-Vol.3 Comb., Sol.,Dust.and Explosives - National Fire Protection Association | Hazardous Materials - Emergency Action Guide - DOT |
|---|---|---|---|---|---|---|
| Materials addressed | | | | | | |
| - Pure | 2 | 2 | 2 | 0 | 2 | 2 |
| - Categories | 2 | 0 | 2 | 1 | 2 | 0 |
| - Mixtures/Wastes | 2 | 0 | 1 | 0 | 2 | 0 |
| - Properties Discussed | 1 | 0 | 1 | 1 | 2 | 1 |
| - Property Changes | 1 | 0 | 1 | 0 | 2 | 1 |
| Immediate Action Presented | | | | | | |
| - Containment | 1 | 0 | 0 | 0 | 1 | 0 |
| - Notification Procedures | 2 | 1 | 0 | 0 | 1 | 1 |
| - Safety Hazards | 2 | 1 | 0 | 1 | 2 | 2 |
| - Evacuation Procedures | 1 | 1 | 1 | 1 | 2 | 2 |
| - Fire Fighting Information | 2 | 1 | 1 | 1 | 2 | 1 |
| - Information Sources | 2 | 0 | 0 | 0 | 2 | 1 |
| - First Aid | 2 | 2 | 0 | 1 | 2 | 2 |

TABLE 10. (continued)

| LEGEND<br>2 - detailed, yes, most<br>1 - mentioned<br>0 - not mentioned not applicable, no, least | Handling Hazardous Materials Transportation Emergencies - Training Course - DOT/NFPA | Chem-cards - MCA | Guide on Hazardous Materials - NFPA | Trem cards - Redland Purle, Ltd. | Chemical Hazards Response Information System (CHRIS) - USCG/DOT | Oil and Hazardous Material Technical Assistance Data System (OHMTADS) | EPA Manual for Control of Hazardous Material Spills - Envirex, Inc. |
|---|---|---|---|---|---|---|---|
| Materials addressed | | | | | | | |
| - Pure | 0 | 2 | 2 | 0 | 2 | 2 | 2 |
| - Categories | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| - Mixtures/Wastes | 0 | 0 | 0 | 2 | 0 | 1 | 1 |
| - Properties Discussed | 0 | 0 | 2 | 0 | 2 | 2 | 1 |
| - Property Changes | 0 | 0 | 1 | 0 | 2 | 2 | 1 |
| Immediate Action Presented | | | | | | | |
| - Containment | 1 | 1 | 0 | 0 | 2 | 1 | 2 |
| - Notification Process | 2 | 2 | 0 | 1 | 1 | 0 | 2 |
| - Safety Hazards | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| - Evacuation Procedures | 1 | 0 | 1 | 1 | 2 | 0 | 0 |
| - Fire Fighting Information | 2 | 2 | 2 | 2 | 2 | 1 | 0 |
| - Information Sources | 2 | 1 | 0 | 0 | 1 | 2 | 1 |
| - First Aid | 0 | 2 | 2 | 1 | 2 | 2 | 0 |

TABLE 10. (continued)

LEGEND

2 - detailed, yes, most
1 - mentioned
0 - not mentioned
not applicable, no, least

| | Field Detection and Damage Assessment Manual for Oil and Hazardous Material Spills - U.S.E.P.A. | Chemical Disposal Techniques for Hazardous Materials - United Parcel Service | Laboratory Waste Manual - MCA | Recommended Methods of Reduction, Neutralization, Recovery or Disposal of | Hazardous Waste Vol.1: Summary Report TRW Systems Group | | |
|---|---|---|---|---|---|---|---|
| Materials addressed | | | | | | | |
| - Pure | 2 | 1 | 2 | 2 | | | |
| - Categories | 0 | 1 | 0 | 0 | | | |
| - Mixtures/Wastes | 1 | 1 | 1 | 1 | | | |
| - Properties Discussed | 1 | 0 | 2 | 0 | | | |
| - Property Changes | 1 | 0 | 0 | 0 | | | |
| Immediate Action Presented | | | | | | | |
| - Containment | 0 | 0 | 0 | 0 | | | |
| - Notification Process | 0 | 0 | 0 | 0 | | | |
| - Safety Hazards | 1 | 1 | 0 | 0 | | | |
| - Evacuation Procedures | 0 | 0 | 0 | 0 | | | |
| - Fire Fighting Information | 0 | 0 | 0 | 0 | | | |
| - Information Sources | 0 | 1 | 0 | 0 | | | |
| - First Aid | 0 | 0 | 0 | 0 | | | |

## TABLE 11. EVALUATION OF RESPONSE SOURCES FOR IDENTIFICATION AND ASSESSMENT PROCEDURES.

LEGEND

2 - detailed, yes, most
1 - mentioned
0 - not mentioned
not applicable, no, least

| | Dangerous Properties of Industrial Materials edited by N. Irving Sax | The Merck Index edited by M. Windholz | Toxic and Hazardous Industrial Chemical Safety Manual - The Int. Technical Info. Institute | Chemical Safety Data Sheet - MCA | Chemistry of Hazardous Materials - E. Meyer | Fire Officers Guide to Dangerous Chemicals--L. W. Bahme | Hazardous Materials Schiele and Pauze |
|---|---|---|---|---|---|---|---|
| Identification Procedures | | | | | | | |
| - Placards/labels | 2 | 0 | 0 | 0 | 2 | 2 | 1 |
| - Bill of Lading | 2 | 0 | 0 | 0 | 0 | 1 | 1 |
| - Tracing Shipper | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| - Phys/chem Properties | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| - Laboratory Testing | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| - Safety Hazards | 2 | 0 | 0 | 0 | 1 | 2 | 1 |
| - Estimate Volume Spilled | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| - Other Ident. for Mixtures/Wastes | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Spill Danger Assessment | | | | | 0 | | |
| - Calculate Area Affected | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| - Weather Input | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| - Sampling Procedure | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| - Consider Population Patterns | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

TABLE 11. (continued)

LEGEND

2 - detailed, yes, most
1 - mentioned
0 - not mentioned
not applicable, no, least

| | Emergency Handling of Hazardous Materials in Surface Transportation - Bureau of Explosives-A.A.R. | Guidelines to the Handling of Hazardous Materials D. J. Behrendsen | Hazardous Materials Handbook - J.H. Meidl | Hazardous Materials Safety Manual - State of Minnesota | National Fire Codes-Vol.3 Comb., Sol.,Dust.and Explosives - National Fire Protection Association | Hazardous Materials - Emergency Action Guide - DOT |
|---|---|---|---|---|---|---|
| Identification Procedures | | | | | | |
| - Placards/labels | 1 | 2 | 1 | 1 | 2 | 1 |
| - Bill of Lading | 0 | 2 | 0 | 0 | 1 | 0 |
| - Tracing Shipper | 0 | 2 | 0 | 0 | 1 | 0 |
| - Phys/chem Properties | 0 | 0 | 0 | 0 | 1 | 0 |
| - Laboratory Testing | 0 | 0 | 0 | 0 | 1 | 0 |
| - Safety Hazards | 0 | 0 | 0 | 0 | 1 | 0 |
| - Estimate Volume Spilled | 0 | 0 | 0 | 0 | 1 | 1 |
| - Other Identification for Mixtures/Wastes | 0 | 0 | 0 | 0 | 0 | 1 |
| | 0 | 0 | 0 | 0 | 0 | 0 |
| Spill Danger Assessment | | | | | | |
| - Calculate Area Affected | 0 | 0 | 0 | 0 | 0 | 2 |
| - Weather Input | 0 | 0 | 0 | 0 | 0 | 0 |
| - Sampling Procedure | 0 | 0 | 0 | 0 | 0 | 0 |
| - Consider Population patterns | 0 | 0 | 0 | 0 | 0 | 1 |

TABLE 11. (continued)

| LEGEND<br>2 - detailed, yes, most<br>1 - mentioned<br>0 - not mentioned<br>not applicable, no, least | Handling Hazardous Materials Transportation Emergencies - Training Course - DOT/NFPA | Chem-cards - MCA | Guide on Hazardous Materials - NFPA | Trem cards - Redland Purle, Ltd. | Chemical Hazards Response Information System (CHRIS) - USCG/DOT | Oil and Hazardous Material Technical Assistance Data System (OHMTADS) | EPA Manual for Control of Hazardous Material Spills - Envirex, Inc. |
|---|---|---|---|---|---|---|---|
| Identification Procedures | | | | | | | |
| - Placards/labels | 2 | 1 | 0 | 1 | 1 | 0 | 2 |
| - Bill of Lading | 2 | 0 | 0 | 1 | 1 | 0 | 2 |
| - Tracing Shipper | 2 | 0 | 0 | 1 | 0 | 0 | 2 |
| - Phys/chem Properties | 2 | 0 | 0 | 0 | 1 | 2 | 1 |
| - Laboratory Testing | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| - Safety Hazards | 2 | 0 | 1 | 0 | 0 | 0 | 1 |
| - Estimate Volume Spilled | 1 | 0 | 0 | 0 | 2 | 0 | 1 |
| - Other Identification for Mixtures/Wastes | 0 | 0 | NFPA method | 0 | 0 | 0 | 1 |
| Spill Danger Assessment | | | | | | | |
| - Calculate Area Affected | 0 | 0 | 0 | 0 | 2 | 0 | 1 |
| - Weather Input | 0 | 0 | 0 | 0 | 2 | 0 | 1 |
| - Sampling Procedure | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| - Consider Population patterns | 0 | 0 | 0 | 0 | 2 | 0 | 1 |

TABLE 11. (continued)

| LEGEND<br>2 - detailed, yes, most<br>1 - mentioned<br>0 - not mentioned<br>not applicable, no, least | Field Detection and Damage Assessment Manual for Oil and Hazardous Material Spills - U.S.E.P.A. | Chemical Disposal Techniques for Hazardous Materials - United Parcel Service | Laboratory Waste Manual - MCA | Recommended Methods of Reduction, Neutralization, Recovery or Disposal of | Hazardous Waste Vol.1: Summary Report TRW Systems Group | | |
|---|---|---|---|---|---|---|---|
| Identification Procedures | | | | | | | |
| - Placards/labels | 1 | 0 | 0 | 0 | | | |
| - Bill of Lading | 1 | 1 | 0 | 0 | | | |
| - Tracing Shipper | 1 | 0 | 0 | 0 | | | |
| - Phys/chem Properties | 2 | 0 | 2 | 0 | | | |
| - Laboratory Testing | 1 | 0 | 0 | 0 | | | |
| - Safety Hazards | 1 | 0 | 0 | 0 | | | |
| - Estimate Volume Spilled | 0 | 0 | 0 | 0 | | | |
| - Other | 0 | 0 | 0 | 0 | | | |
| Spill Danger Assessment | | | | | | | |
| - Calculate Area Affected | 0 | 0 | 0 | 0 | | | |
| - Weather Input | 0 | 0 | 0 | 0 | | | |
| - Sampling Procedure | 0 | 0 | 0 | 0 | | | |
| - Consider Population patterns | 0 | 0 | 0 | 0 | | | |

TABLE 12. EVALUATION OF RESPONSE SOURCES FOR CONTAINMENT AND ENVIRONMENTAL HAZARD INFORMATION.

| LEGEND<br>2 - detailed, yes, most<br>1 - mentioned<br>0 - not mentioned<br>not applicable, no, least | Dangerous Properties of Industrial Materials edited by N. Irving Sax | The Merck Index edited by M. Windholz | Toxic and Hazardous Industrial Chemical Safety Manual - The Int. Technical Info. Institute | Chemical Safety Data Sheet - MCA | Chemistry of Hazardous Materials - E. Meyer | Fire Officers Guide to Dangerous Chemicals- -L. W. Bahme | Hazardous Materials Schiele and Pauze |
|---|---|---|---|---|---|---|---|
| Hazard and Environmental Impact | | | | | | | |
| - Animal Toxicity | 0 | 2 | 2 | 2 | 0 | 0 | 2 |
| - Human Toxicity | 1 | 1 | 2 | 2 | 2 | 0 | 2 |
| - Aquatic Toxicity | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| - Dermal Toxicity | 0 | 0 | 0 | 2 | 2 | 0 | 1 |
| - Flamm/Explosive | 2 | 0 | 2 | 2 | 2 | 2 | 2 |
| - Vegetation | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| - Water Supply Threat | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Containment Methods | | | | 0 | | | |
| - Air | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| - Land | 2 | 0 | 1 | 0 | 0 | 1 | 1 |
| - Water | 2 | 0 | 0 | 0 | 0 | 1 | 1 |
| - Safety Hazards | 1 | 0 | 1 | 2 | 0 | 2 | 2 |
| - Procedure (eg. details) | 1 | 0 | 1 | 0 | 0 | 0 | 1 |

TABLE 12. (continued)

| LEGEND<br>2 - detailed, yes, most<br>1 - mentioned<br>0 - not mentioned<br>not applicable, no, least | Emergency Handling of Hazardous Materials in Surface Transportation - Bureau of Explosives-A.A.R. | Guidelines to the Handling of Hazardous Materials D. J. Behrendsen | Hazardous Materials Handbook - J.H. Meidl | Hazardous Materials Safety Manual - State of Minnesota | National Fire Codes-Vol.3 Comb., Sol.,Dust.and Explosives - National Fire Protection Association | Hazardous Materials - Emergency Action Guide - DOT |
|---|---|---|---|---|---|---|
| Hazard and Environmental Impact | | | | | | |
| - Animal Toxicity | 0 | 0 | 0 | 0 | 0 | 0 |
| - Human Toxicity | 2 | 1 | 1 | 0 | 1 | 1 |
| - Aquatic Toxicity | 0 | 0 | 0 | 0 | 0 | 0 |
| - Dermal Toxicity | 1 | 0 | 1 | 0 | 1 | 1 |
| - Flamm/Explosive | 2 | 1 | 1 | 1 | 2 | 2 |
| - Vegetation | 0 | 0 | 0 | 0 | 0 | 0 |
| - Water Supply Threat | 0 | 0 | 0 | 1 | 1 | 1 |
| Containment Methods | | | | | | |
| - Air | 0 | 0 | 0 | 0 | 0 | 0 |
| - Land | 1 | 0 | 0 | 0 | 0 | 0 |
| - Water | 0 | 0 | 0 | 0 | 0 | 1 |
| - Safety Hazards | 0 | 0 | 0 | 0 | 0 | 0 |
| - Procedure (eg. details) | 1 | 0 | 0 | 0 | 0 | 1 |

TABLE 12. (continued)

| LEGEND<br>2 - detailed, yes, most<br>1 - mentioned<br>0 - not mentioned<br>not applicable, no, least | Field Detection and Damage Assessment Manual for Oil and Hazardous Material Spills - U.S.E.P.A. | Chemical Disposal Techniques for Hazardous Materials - United Parcel Service | Laboratory Waste Manual - MCA | Recommended Methods of Reduction, Neutralization, Recovery or Disposal of Hazardous Waste Vol.1: Summary Report TRW Systems Group | | | |
|---|---|---|---|---|---|---|---|
| Hazard and Environmental Impact | | | | | | | |
| - Animal Toxicity | 1 | 0 | 0 | 0 | | | |
| - Human Toxicity | 1 | 0 | 1 | 0 | | | |
| - Aquatic Toxicity | 1 | 0 | 0 | 0 | | | |
| - Dermal Toxicity | 0 | 1 | 0 | 0 | | | |
| - Flamm/Explosive | 0 | 0 | 0 | 0 | | | |
| - Vegetation | 1 | 0 | 0 | 0 | | | |
| - Water Supply Threat | 0 | 0 | 0 | 0 | | | |
| Containment Methods | | | | | | | |
| - Air | 0 | 0 | 0 | 0 | | | |
| - Land | 0 | 0 | 0 | 1 | | | |
| - Water | 0 | 0 | 0 | 1 | | | |
| - Safety Hazards | 1 | 0 | 1 | 1 | | | |
| - Procedure (eg. details) | 0 | 0 | 1 | 1 | | | |

TABLE 12. (continued)

| LEGEND<br>2 - detailed, yes, most<br>1 - mentioned<br>0 - not mentioned<br>not applicable, no, least | Handling Hazardous Materials Transportation Emergencies - Training Course - DOT/NFPA | Chem-cards - MCA | Guide on Hazardous Materials - NFPA | Trem cards - Redland Purle, Ltd. | Chemical Hazards Response Information System (CHRIS) - USCG/DOT | Oil and Hazardous Material Technical Assistance Data System (OHMTADS) | EPA Manual for Control of Hazardous Material Spills - Envirex, Inc. |
|---|---|---|---|---|---|---|---|
| Hazard and Environmental Impact | | | | | | | |
| - Animal Toxicity | 0 | 0 | 1 | 0 | 2 | 2 | 0 |
| - Human Toxicity | 0 | 2 | 2 | 0 | 2 | 2 | 0 |
| - Aquatic Toxicity | 0 | 0 | 1 | 0 | 2 | 2 | 0 |
| - Dermal Toxicity | 0 | 2 | 2 | 0 | 2 | 2 | 0 |
| - Flamm/Explosive | 0 | 2 | 2 | 2 | 2 | 2 | 0 |
| - Vegetation | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| - Water Supply Threat | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| - Spill Assessment | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Containment Methods | | | | | | | |
| - Air | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| - Land | 0 | 1 | 0 | 2 | 1 | 1 | 2 |
| - Water | 0 | 1 | 0 | 1 | 2 | 1 | 2 |
| - Safety Hazards | 2 | 2 | 0 | 1 | 1 | 0 | 1 |
| - Procedure (eg. details) | 0 | 1 | 0 | 1 | 2 | 0 | 1 |

TABLE 13. EVALUATION OF RESPONSE SOURCES FOR CLEAN-UP TECHNIQUES.

| LEGEND<br>2 - detailed, yes, most<br>1 - mentioned<br>0 - not mentioned<br>not applicable, no, least | Dangerous Properties of Industrial Materials edited by N. Irving Sax | The Merck Index edited by M. Windholz | Toxic and Hazardous Industrial Chemical Safety Manual - The Int. Technical Info. Institute | Chemical Safety Data Sheet - MCA | Chemistry of Hazardous Materials - E. Meyer | Fire Officers Guide to Dangerous Chemicals- -L. W. Bahme | Hazardous Materials Schiele and Pauze |
|---|---|---|---|---|---|---|---|
| Clean-up Procedure | | | | | | | |
| - Sampling Procedure | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| - Substance Specific | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| - Situation Evaluation | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| - Instructions | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| - Difficulties Discussed | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| - Safety Precautions | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| - Discharge Standards | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| - Disposal Methods | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| - Applicable to Hazardous **Wastes** | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Flexibility | | | | | | | |
| 1) Land/Air/Water Spills | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2) Complete Proc. for each | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3) Access w/o identity of materials | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

TABLE 13. (continued)

| LEGEND<br>2 - detailed, yes, most<br>1 - mentioned<br>0 - not mentioned<br>not applicable, no, least | Emergency Handling of Hazardous Materials in Surface Transportation - Bureau of Explosives-A.A.R. | Guidelines to the Handling of Hazardous Materials<br>D. J. Behrendsen | Hazardous Materials Handbook - J.H. Meidl | Hazardous Materials Safety Manual - State of Minnesota | National Fire Codes-Vol.3 Comb., Sol.,Dust.and Explosives - National Fire Protection Association | Hazardous Materials - Emergency Action Guide - DOT |
|---|---|---|---|---|---|---|
| Clean-up Procedure | | | | | | |
| - Sampling Procedure | 0 | 0 | 0 | 0 | 0 | 0 |
| - Substance Specific | 0 | 0 | 0 | 0 | 0 | 0 |
| - Situation Evaluation | 0 | 0 | 0 | 0 | 0 | 0 |
| - Instructions | 0 | 0 | 0 | 0 | 0 | 0 |
| - Difficulties Discussed | 0 | 0 | 0 | 1 | 0 | 0 |
| - Safety Precautions | 0 | 0 | 0 | 0 | 0 | 0 |
| - Discharge Standards | 0 | 0 | 0 | 0 | 0 | 0 |
| - Disposal Methods | 0 | 0 | 0 | 0 | 0 | 0 |
| - Applicable to Hazardous Waste | 0 | 0 | 0 | 0 | 0 | 0 |
| Flexibility | | | | | | |
| 1) Land/Air/Water Spills | 2 | 2 | 0 | 2 | 2 | 2 |
| 2) Complete Proc. for each | 0 | 0 | 0 | 0 | 0 | 0 |
| 3) Access w/o identity of materials | 0 | 2 | 0 | 2 | 0 | 0 |

TABLE 13. (continued)

| LEGEND<br>2 - detailed, yes, most<br>1 - mentioned<br>0 - not mentioned not applicable, no, least | Handling Hazardous Materials Transportation Emergencies - Training Course - DOT/NFPA | Chem-cards - MCA | Guide on Hazardous Materials - NFPA | Trem cards - Redland Purle, Ltd. | Chemical Hazards Response Information System (CHRIS) - USCG/DOT | Oil and Hazardous Material Technical Assistance Data System (OHMTADS) | EPA Manual for Control of Hazardous Material Spills - Envirex, Inc. |
|---|---|---|---|---|---|---|---|
| Clean-up Procedure | | | | | | | |
| - Sampling Procedure | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| - Substance Specific | 0 | 0 | 0 | 0 | 1 | 2 | 2 |
| - Situation Evaluation | 0 | 0 | 0 | 0 | 1 | 0 | 2 |
| - Instructions | 0 | 0 | 0 | 1 | 1 | 1 | 2 |
| - Difficulties Discussed | 0 | 0 | 0 | 1 | 1 | 0 | 2 |
| - Safety Precautions | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| - Discharge Standards | 0 | 0 | 0 | 0 | 0 | 2 | 1 |
| - Disposal Methods | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| - Applicable to Hazardous Wastes | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Flexibility | | | | | | | |
| 1) Land/Air/Water Spills | 1 | 2 | 0 | 1 | 1 | 1 | 1 |
| 2) Complete Proc. for each | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 3) Access w/o identity of materials | 0 | 0 | 0 | 1 | 0 | 2 | 0 |

TABLE 13. (continued)

| LEGEND<br>2 - detailed, yes, most<br>1 - mentioned<br>0 - not mentioned<br>not applicable, no, least | Field Detection and Damage Assessment Manual for Oil and Hazardous Material Spills - U.S.E.P.A. | Chemical Disposal Techniques for Hazardous Materials - United Parcel Service | Laboratory Waste Manual - MCA | Recommended Methods of Reduction, Neutralization, Recovery or Disposal of | Hazardous Waste Vol.1: Summary Report TRW Systems Group | | |
|---|---|---|---|---|---|---|---|
| Clean-up Procedure | | | | | | | |
| - Sampling Procedure | 0 | 0 | 0 | 0 | | | |
| - Substance Specific | 0 | 1 | 1 | 0 | | | |
| - Situation Evaluation | 0 | 1 | 1 | 0 | | | |
| - Instructions | 0 | 1 | 2 | 0 | | | |
| - Difficulties Discussed | 0 | 1 | 1 | 0 | | | |
| - Safety Precautions | 0 | 1 | 1 | 0 | | | |
| - Discharge Standards | 0 | 0 | 0 | 0 | | | |
| - Disposal Methods | 0 | 1 | 1 | 0 | | | |
| - Applicable to Hazardous **Wastes** | 0 | 1 | 1 | 0 | | | |
| Flexibility | | | | | | | |
| 1) Land/Air/Water Spills | 1 | 1 | 2 | 1 | | | |
| 2) Complete Proc. for each | 0 | 1 | 1 | 1 | | | |
| 3) Access w/o identity of materials | 2 | 0 | 0 | 0 | | | |

TABLE 14. EVALUATION OF RESPONSE SOURCES FOR AUDIENCE ADDRESSED AND CLARITY

| | Dangerous Properties of Industrial Materials edited by N. Irving Sax | The Merck Index edited by M. Windholz | Toxic and Hazardous Industrial Chemical Safety Manual - The Int. Technical Info. Institute | Chemical Safety Data Sheet - MCA | Chemistry of Hazardous Materials - E. Meyer | Fire Officers Guide to Dangerous Chemicals- -L. W. Bahme | Hazardous Materials Schiele and Pauze |
|---|---|---|---|---|---|---|---|
| Audience Addressed | | | | | | | |
| 1) General Public | no | no | no | no | no | no | no |
| 2) Carriers | no | no | yes | no | no | no | no |
| 3) Em Resp. Personnel | no | no | yes | no | yes | yes | yes |
| 4) Highly Trained Technical Personnel | yes | yes | yes | yes | yes | yes | yes |
| **Clarity** | | | | | | | |
| 1) Highlight Important Instructions | some | no | some | some | no | no | no |
| 2) Short and Concise | no | entries are | entries are | yes | yes | yes | yes |
| 3) Ability to Apply Info. Quickly/ Effectively | no | yes | yes | yes | no | no | no |
| 4) Repetition | no | no | some | no | no | no | no |
| 5) Refer to Other Sources | yes | yes | no | no | some | yes | yes |
| 6) General Readability | poor | OK | good | OK | OK | OK | OK |
| 7) Bulkiness | 1 book | 1 book | 1 book | sheets | book | small | book |

TABLE 14. (continued)

| | Emergency Handling of Hazardous Materials in Surface Transportation - Bureau of Explosives-A.A.R. | Guidelines to the Handling of Hazardous Materials D. J. Behrendsen | Hazardous Materials Handbook - J.H. Meidl | Hazardous Materials Safety Manual - State of Minnesota | National Fire Codes-Vol.3 Comb., Sol.,Dust.and Explosives - National Fire Protection Association | Hazardous Materials - Emergency Action Guide - DOT |
|---|---|---|---|---|---|---|
| Audience Addressed | | | | | | |
| 1) General Public | no | no | no | no | no | yes |
| 2) Carriers | yes | yes | no | yes | no | yes |
| 3) Em Resp. Personnel | yes | yes | yes | yes | yes | yes |
| 4) Highly Trained Technical Personnel | yes | yes | yes | yes | yes | yes |
| Clarity | | | | | | |
| 1) Highlight Important Instructions | yes | yes | some | yes | some | yes |
| 2) Short and Concise | yes | yes | yes | yes | yes | yes |
| 3) Ability to Apply Info. Quickly/Effectively | good | good | some | good | good | excellent |
| 4) Repetition | some | some | no | no | no | no |
| 5) Refer to Other Sources | some | some | yes | yes | no | yes |
| 6) General Readability | OK | OK | OK | OK | difficult | excellent |
| 7) Bulkiness | small | small | small | small<br>short | small | small |

TABLE 14. (continued)

| | Handling Hazardous Materials Transportation Emergencies - Training Course - DOT/NFPA | Chem-cards - MCA | Guide on Hazardous Materials - NFPA | Trem cards - Redland Purle, Ltd. | Chemical Hazards Response Information System (CHRIS) - USCG/DOT | Oil and Hazardous Material Technical Assistance Data System (OHMTADS) | EPA Manual for Control of Hazardous Material Spills - Envirex, Inc. |
|---|---|---|---|---|---|---|---|
| Audience Addressed | | | | | | | |
| 1) General Public | no | yes | no | no | Vol.1 | no | no |
| 2) Carriers | no | yes | yes | yes | Vol.1 | no | no |
| 3) Em Resp. Personnel | yes | yes | yes | yes | Vol.1 | no | no |
| 4) Highly Trained Technical Personnel | yes | yes | yes | yes | Vol.2-4 | yes | yes |
| Clarity | NA | | | | | | |
| 1) Highlight Important Instructions | | yes | some | yes | Vol.1 | no | some |
| 2) Short and Concise | | yes | some | yes | no | yes | no |
| 3) Ability to Apply Info. Quickly/Effectively | | good | not good | good | Vol.1 | poor | poor |
| 4) Repetition | | no | some | no | some | yes | some |
| 5) Refer to Other Sources | | yes | yes | yes | yes | yes | yes |
| 6) General Readability | | good | difficult | good | difficult | difficult | difficult |
| 7) Size | | 1 card | small | 1 sheet | 4 volumes | sheets | 1 lg.volume |

TABLE 14. (continued)

| | Field Detection and Damage Assessment Manual for Oil and Hazardous Material Spills - U.S.E.P.A. | Chemical Disposal Techniques for Hazardous Materials - United Parcel Service | Laboratory Waste Manual - MCA | Recommended Methods of Reduction, Neutralization, Recovery or Disposal of | Hazardous Waste Vol.1: Summary Report TRW Systems Group | | |
|---|---|---|---|---|---|---|---|
| Audience Addressed | | | | | | | |
| 1) General Public | no | no | no | no | | | |
| 2) Carriers | no | yes | no | no | | | |
| 3) Em Resp. Personnel | no | yes | can use | no | | | |
| 4) Highly Trained Technical Personnel | yes | yes | laboratory | yes | | | |
| Clarity | | | | | | | |
| 1) Highlight Important Instructions | yes | yes | yes | NA | | | |
| 2) Short and Concise | yes | yes | yes | no | | | |
| 3) Ability to Apply Info. Quickly/Effectively | yes | yes | yes | yes | | | |
| 4) Repetition | no | no | no | no | | | |
| 5) Refer to Other Sources | some | no | no | yes | | | |
| 6) General Readability | good* | good | good | OK | | | |
| 7) Size | small | small | small | 16 Vol. | | | |

* small print

TABLE 15. EVALUATION OF RESPONSE SOURCES FOR FLEXIBILITY, PRIOR TRAINING AND MEETING STATED OBJECTIVES

| | Dangerous Properties of Industrial Materials edited by N. Irving Sax | The Merck Index edited by M. Windholz | Toxic and Hazardous Industrial Chemical Safety Manual - The Int. Technical Info. Institute | Chemical Safety Data Sheet - MCA | Chemistry of Hazardous Materials - E. Meyer | Fire Officers Guide to Dangerous Chemicals--L. W. Bahme | Hazardous Materials Schiele and Pauze |
|---|---|---|---|---|---|---|---|
| Requirement for Prior Training | | | | | | | |
| 1) Mandatory - technical training | yes | yes | desirable | desirable | desirable | desirable | desirable |
| 2) Short Course Acceptable | no | no | yes | yes | yes | yes | yes |
| 3) Orientation Only | no | no | no | no | no | no | no |
| 4) Self-explanatory w/o training | no | no | no | no | no | no | no |
| Degree to which met objectives | OK | good | good | good | good | good | good |
| | | | | | | | |
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TABLE 15. (continued)

|  | Emergency Handling of Hazardous Materials in Surface Transportation - Bureau of Explosives-A.A.R | Guidelines to the Handling of Hazardous Materials D. J. Behrendsen | Hazardous Materials Handbook - J. H. Meidl | Hazardous Materials Safety Manual - State of Minnesota | National Fire Codes-Vol.3 Comb., Sol.,Dust.and Explosives - National Fire Protection Association | Hazardous Materials - Emergency Action Guide - DOT |
|---|---|---|---|---|---|---|
| Requirement for Prior Training |  |  |  |  |  |  |
| 1) Mandatory-technical training | no | no | no | no | no | no |
| 2) Short Course Acceptable | no | no | desirable | no | desirable | no |
| 3) Orientation Only | desirable | desirable | yes | desirable | yes | no |
| 4) Self-explanatory w/o training | yes | yes | no | yes | no | yes |
| Degree to which met training objectives | good | good | good | good | good | excellent |

TABLE 15. (continued)

| | Handling Hazardous Materials Transportation Emergencies - Training Course - DOT/NFPA | Chem-cards - MCA | Guide on Hazardous Materials - NFPA | Trem cards - Redland Purle, Ltd. | Chemical Hazards Response Information System (CHRIS) - USCG/DOT | Oil and Hazardous Material Technical Assistance Data System (OHMTADS) | EPA Manual for Control of Hazardous Material Spills - Envirex, Inc. |
|---|---|---|---|---|---|---|---|
| Requirement for Prior Training | | | | | | | |
| 1) Mandatory - technical training | NA | no | no | no | Vol. 2-4 | yes | desirable |
| 2) Short Course Acceptable | | no | yes | no | Vol. 2 | no | yes |
| 3) Orientation Only | | no | no | no | Vol. 2 | no | no |
| 4) Self-explanatory w/o training | | yes | no | yes | Vol. 1 | no | no |
| Degree to which met objectives | good | good | yes<br>good | good | good | good | good |
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TABLE 15. (continued)

| | Field Detection and Damage Assessment Manual for Oil and Hazardous Material Spills - U.S.E.P.A. | Chemical Disposal Techniques for Hazardous Materials - United Parcel Service | Laboratory Waste Manual - MCA | Recommended Methods of Reduction, Neutralization, Recovery or Disposal of Hazardous Waste Vol.1: Summary Report TRW Systems Group | | |
|---|---|---|---|---|---|---|
| Requirement for Prior Training | | | | | | |
| 1) Mandatory - technical training | no | no | no | yes | | |
| 2) Short Course Acceptable | desirable | no | no | no | | |
| 3) Orientation Only | yes | yes | yes | no | | |
| 4) Self-explanatory w/o training | no | no | no | no | | |
| Degree to which met objectives | excellent | good | good | good | | |
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## TABLE 16. SUMMARY OF RESPONSE TEAM CAPABILITIES

| | Access | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Response Teams | 24 Hour Telephone | CHEMTREC | Available to General Public | Regional Offices | Materials Covered | Response Time | Consult- On-Site or Remote | Actual Containment | Actual Clean-up |
| National Response Team/Regional Response Team (NRT/RRT) | Yes | No | Yes | Yes | CWA<br>Sec 311 | Varies | Both | No | No |
| U.S. Coast Guard National Strike Force (NSF) | Thru NRC | No | Yes | Yes<br>3 Teams | 311 | 1-2 in 2 hrs<br>4-6 in 4 hrs<br>Full Team in 12 Hrs | On-Site | Depends on the Situation | |
| U.S. Army Chemical Emergency Team | Yes | No | No | No | Military Chemicals<br>No Explosives | 2 Hours Plus Travel | On-Site Or Remote-More Remote | Reconnaissance | Yes - incineration is common |
| Interagency Radiological Assistance Plan (IRAP) | No | Yes | Yes | No | Radioactive Only | 15 min-1 Hour | Both | Covering | No |
| Chlorine Emergency Plan (CHLOREP) | No | Yes | Yes | Yes | Chlorine Substances | 24 Hours | Both | Stoppage Of Leaks | Stop Leaks Allows Gas To Dissipate |

continued

## TABLE 16. (continued)

| Response Teams | Equipment<br>Safety | <br>Containment | <br>Treatment | <br>Other | Funding | Frequency Of Use (Spills/Year) | Comments |
|---|---|---|---|---|---|---|---|
| NRT/RRT | Some | Some | No | Have List Of Available Materials | EPA-Fund With Cost Recovery | Depends On Area | Are Central Coordinator For Spills |
| NSF | Some | Booms, Vacuum Trucks, Pumps Skimmers | No | Use Contractors As Needed | Pollution Fund With Cost Recovery | Varies 2-6/ Month Per Region - Not All Major | |
| U.S. Army Chemical Emergency Team | Some | | 400 Gal Tanks Chemicals Pumps | Special Decontainment Apparatus | Army | No Major Response In 2-3 Years Some Remote Advice | Can Access Through Proper Channels Only |
| IRAP | Special Clothing | | | Radiation Dectors and Counters | Department of Energy | 1 Per Year | |
| CHLOREP | Special Clothing | Capping Devices | Not Applicable | | Chlorine Manufacturers | | |

# SECTION VII

## SUMMARY AND RECOMMENDED SYSTEMS

Emergency response systems for spill handling and clean-up have been discussed and evaluated in the previous sections of this report. Only one source has been directed to handling hazardous waste spills, although other manuals may be pertinent to identified and relatively pure hazardous wastes. The major problem associated with spill response to hazardous waste is that of identification. Only a few hazardous waste streams are pure or mostly pure materials. Most are liquid mixtures of various batch dumps or continuous streams, sludges, slurries or other undesirable by-products of production operation. Even when the hazardous components are known, technical interpretation may be needed to correctly apply the available information. Therefore, existing resources must be used with care in order to assure safe, appropriate response. This section includes a brief summary of the evaluation results and the contractor's recommendations regarding changes to existing emergency response systems to allow effective response to hazardous waste spills.

### Summary of Various Response Systems

Notification/Reporting Requirements. State and Federal laws usually require notification of proper authorities when a spill occurs. On a national level, there are different requirements depending upon the type of material spilled and the spill location. A single toll free number has been developed although it is generally used for reporting spills of oil and the EPA hazardous substances. It may be necessary for the spiller to notify more than one source depending upon the situation.

State laws are seldom limited by lists of defined hazardous materials and are more encompassing. Spills of any hazardous materials are covered and location is often not specified. State laws which may be applicable include general water pollution laws, specific spill regulations or hazardous waste generator requirements. Notification usually involves contact to an answering service - with later follow-up technical spill response personnel. In some instances, a call list is available to the spiller who is required to continue contacts until a responsible party is notified. Neither system is perfect since technical advice to on-site personnel is seldom available as quickly as needed. Problems also exist regarding who should be notified first on the Federal/State level and within the State agencies themselves.

Written reporting requirements are also variable. Although the basic content is similar, a spiller may be required to submit different reports to different agencies. Usually written reports include a brief summary of why the spill occurred, how it was mitigated and what is being done to prevent a recurrence. The reports may be completed by the spiller and/or the State/Federal OSC at the spill site.

Response Manuals and Information Sources. The response manuals and information sources have been classified into five types. A thorough evaluation of their output, ease of use and applicability to hazardous waste spills was included in the previous section. These results are summarized by type of response system.

Telephone Contact Sources. Seven different telephone contact sources of spill information have been evaluated using five main criteria: access and response time, amount of input needed, variety of chemicals addressed, availability of computerized data and type of output. Because of the nature of this source, detailed and complex outputs are usually not desirable. Instead, availability, applicability to many chemicals, and a fast response are more crucial.

The general approach used by CHEMTREC or TEAP appears to be feasible. They are available 24 hours a day and can provide fast initial response information on a large number of chemicals. Their main limitation is that they have no way of accessing the information without knowledge of the identity of the chemical spilled. Therefore, they have little applicability to mixtures and similarly unidentified hazardous wastes. OHM-TADS has provision for a search function which can identify chemicals. However, it has limited accessibility and an extremely technical output which makes it more difficult to use. Information retrieval systems have long response times, and a very technical output which may not include the information directly. These limitations reduce their usefulness for any type of spill response.

Specialty response organizations which offer telephone contacts (CHLOREP, IRAP) are desirable since fast detailed information can be transmitted to the spiller quickly. However, their limitations with respect to types of chemicals severely inhibit their applicability to hazardous waste spills.

Background Information Sources. Background information sources can include a large variety of references, textbooks, handbooks or manuals. Nine sources were reviewed to provide typical examples of these resources. Background sources were classified as two types: one which presented toxicity or other technical data; and one which discussed the dangers to a firefighter from handling hazardous materials.

The technical background sources present needed information to trained personnel who must interpret the data for application to a specific spill incident. Among the information available from these sources are toxicity data, first aid procedures, handling methods and various physical or chemical properties of a given compound. These sources are most useful for confirming the validity of an approach to spill control. They have no applicability to hazardous waste spills unless the identities of the components are known.

Texts directed to firefighters have a major objective to alert these emergency personnel to the potential dangers associated with hazardous materials spills. They generally group chemicals into generic classifications and discuss overall hazards with some specific information. Basic techniques for dealing with spills of chemicals are presented and the associated safety precautions are stressed. These texts aim to educate the firefighters and are more valuable when taught in an associated short course. In most cases, they would not be very helpful in guiding initial response since the information which they include is not well indexed or all inclusive. Hazardous wastes are not specifically addressed but if they can be categorized under some of the given generic classifications, appropriate control techniques have been included.

Immediate Response Manuals. Many different manuals have been written which address response in the first 30 minutes to 2 hours after a spill occurrence. These manuals generally recommend initial firefighting procedures, first aid techniques, and general responses required (evacuation, restriction of access, etc.). The basic hazards associated with the spilled chemical are also outlined. Probably the most important evaluation criteria for intial response manuals are the ease of use criteria. These include audience addressed, clarity, and level of training required. One of the manuals which meets the criteria best is the DOT's Hazardous Materials - Emergency Action Guide. This guide presents information graphically and simply enough to be used by almost anyone in any situation. The main instructions are highlighted for ease of use. Its major limitations are that it addresses only 43 chemicals and is not directly applicable to unidentified hazardous waste spills.

In general, the initial response manuals are written for carriers and emergency response personnel. Their clarity varies, depending upon the number of chemicals addressed and the scope of the information available. Most initial response manuals are flexible in that they cover spills on land or water. One significant difference between these initial response manuals was the way different chemicals were accessed. In some manuals, materials were accessed only if their specific identity was known, while in others the access was through DOT placard type which establishes a general hazard classification. This difference could be significant when dealing with hazardous wastes which may not be specifically identified at a spill site. Identification of the immediate hazard as indicated by DOT placard type can usually be a accomplished more quickly and is useful for initial response.

One of the sources reviewed, the Redland Purle Tremcards, was specifically addressed to hazardous waste incidents. In this system, wastes were categorized into twelve types, their associated hazards addressed and initial response actions presented.

Complete Response Manuals. There were very few sources available which attempted to address the total problem of spill response. Even among the three sources reviewed and evaluated, there were significant differences due to variations in scope and certain specific objectives. The CHRIS manuals presented the most information with respect to overall spill response. Their four volume format allowed each handbook to address a different aspect of spill response both with respect to subject matter and audience addressed. CHRIS Volume 1 is actually an initial response manual for some 200 selected chemicals, while CHRIS Volume 2 provides both background information and assessment/response codes. CHRIS Volume 3 provides detailed methods for assessing spill hazard while Volume 4 is a more general approach to in place treatment of spills in large water bodies.

Probably the main weaknesses of CHRIS are the lack of a detailed section on clean-up techniques, its limitation to water spills and the need to know the identity of the spilled material before information can be obtained.

OHM-TADS has been classified in this report as a complete response manual even though information is available only through microfiche or a computer printout. OHM-TADS includes a large amount of information, especially with respect to toxicity data, chemical properties and shipments. Response information is available but on a very basic level, since details are not included with respect to implementation. Another weakness of OHM-TADS is that it may not include information on a given subject matter which may be extremely critical (e.g., disposal methods) because no published information was available when the source was developed. However, the one page computer printout is very easy to handle and use, once someone is familiar with the format.

The EPA Manual for Control of Hazardous Material Spills, Volume 1, mainly addresses clean-up of water spills with an in place but off stream manner. This manual includes detailed information regarding implementation of treatment techniques. No toxicity or first aid information is included, rather other sources are referenced. Emphasis has been placed on methods of spill identification, evaluation of the best control technique and implementation of various treatment processes using improvised systems. Disposal procedures are not addressed. By itself, this manual is not complete, since initial response is not covered, however, it has referenced other sources which contain this information in an attempt to reduce repetition and volume.

One of the main limitations with all three of these manuals is the level of audience addressed. All, except CHRIS Volume 1, present technical information which will require either interpretation by a technical advisor or extensive user training through a specific orientation course. None of the manuals address hazardous wastes and all must be specifically accessed through the chemical identity. The EPA manual presents methods of identification, mentions mixtures and includes techniques for on site testing, all of which might be helpful when dealing with a hazardous waste spill although the procedures are directed to pure materials. The application of this information would require interpretation by a technical advisor since the intraction of hazardous waste components must also be considered.

Detection/Assessment and Disposal Manuals. These manuals address different aspects of spill response. With regard to detection/assessment, the EPA Field Detection and Damage Assessment Manual for Oil and Hazardous Materials provides complete information which is directed to a technical field crew. Although this source does not address hazardous wastes directly, most of the information would still be applicable.

Disposal manuals for spills are usually addressed to small occurrences. Both laboratory or small parcel type situations are addressed. Little information is available on full-scale disposal of a large amount of spill clean-up residues. The techniques presented in the TRW report "Recommended Methods of Reduction, Neutralization, Recovery of Disposal of Hazardous Waste" may be applied but only on a general basis. Hazardous wastes mixtures are not addressed directly through these sources since even the TRW report considers identifiable components of the wastes and not mixed batches. It would be difficult to use this available information for a hazardous waste spill.

## Recommended Response Systems For Handling Hazardous Waste Spills

Notification/Reporting Requirements. Notification requirements for those involved in hazardous waste spill incidents should be as simple as possible and should have the potential to offer needed immediate response information. Since a toll free number already is being used for pure hazardous material spill notification, the service should be extended to include accepting notification for hazardous waste spills and to provide some preliminary information pertinent to initial response and protection of human health.

Upon receipt of a notification call, the duty officer shall as a minimum receive the following information:

1. Name of caller
2. Call-back number
3. Location of the spill (highway number) etc.
4. Identity of the spilled material (if available)
5. Approximate volume of material spilled
6. Type of media affected
7. Length of time since spill occurrence
8. What type of emergency personnel are on scene

If the identity of the waste is known, the duty officer can transmit some critical initial response information including fire, explosion and health danger, evacuation distance and general precautions to be taken at the spill site. If the identity of the waste is unknown, the spiller can be directed to follow procedures for an extremely hazardous material depending on the location of the spill and the volume involved. In either event, the spiller can receive pertinent first response information with a single telephone call.

After the notification, it would then be the responsibility of the nationwide center to transmit the notification information to proper State and Federal agencies. For this purpose, they must have available up-to-date information from the States regarding call lists, duty officers, etc.

This procedure offers several advantages. First, the caller can contact one number, receive some pertinent response information and fulfill notification requirements for all spill types. The second contact can be performed by the center to the appropriate agency presented in the regulations. Using this approach, a single number can be distributed to all concerned with transportation or handling of hazardous materials.

A single report should be required per incident. The format can be developed on an interagency basis to allow one record of pertinent information. The form should be completed by the spiller with copies sent to appropriate Federal and State agencies. When the spill coordinators are required to complete a report, the documents should be transmitted together.

It is anticipated that at a minimum, the following information must be included in a report:

1. Type and volume of material spilled
2. Location of spill
3. Cause of incident
4. Who was notified
5. Type of immediate action taken
6. Type of complete action taken
7. Disposal method
8. What is being done to prevent future incidents

Classification and Marking System. The most critical problem associated with response to hazardous waste spills is the lack of positive identification of the materials spilled. This means that the associated hazards of the waste chemicals are also unknown. This lack of information could result in a safety hazard for initial response personnel. Due to the nature and variability of hazardous wastes, it may not be economically feasible to require an industry to specifically identify every component in a given waste load, just in case a spill would occur. Even if this information was required on a bill of lading, it may not be accessible or understandable to emergency response personnel first on the scene.

Classification. It is therefore recommended that hazardous wastes be classified into standard categories which will allow the development of safe response procedures in the event of a spill incident. This approach is similar to that used by Redland Purle in their Tremcards, although more categories may be needed for establishing response techniques. The effort will require review of the waste streams and components with respect to the hazards associated with the waste (toxic, flammable, explosive, corrosive, oxidant, etc.), the form of the material (liquid, slurry, solid) and possibly its potential interaction with water, air and soil (water - float, sink, mix, soil - adsorb or not, air - heavier or lighter). It may be possible to attempt classification by industry type if the hazards and associated response techniques are similar between waste streams.

Marking. After the classification system has been established, it is recommended that associated vehicle identification markings be developed to correspond to these categories. These may be similar to the required DOT placards but possibly should include a color code which indicates that the contents are a waste material rather than a pure chemical. This code will alert emergency response personnel who can then refer to those sources of information developed for control of hazardous waste spills.

The markings will protect the safety of those first on the scene of the incident, since an immediate indication of the hazards is available. Once appropriate human health and environmental protection steps have been taken, the specific identity of the waste can be established and appropriate control measures initiated.

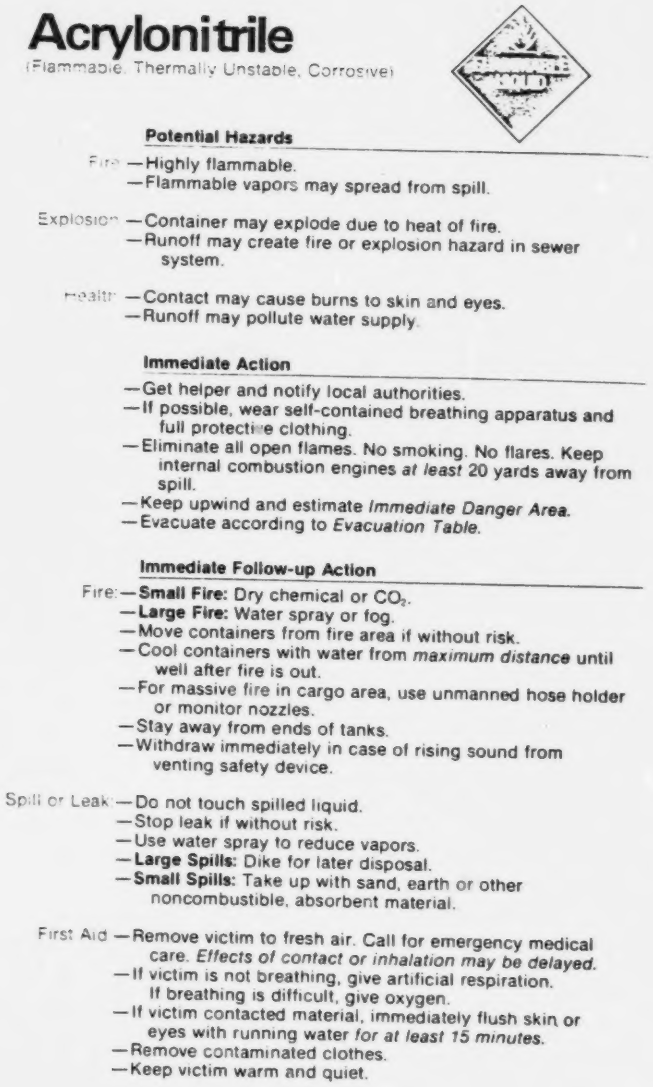
Telephone Contact Source. Initial response information for waste spills is not presently available. Since CHEMTREC is an effective, well known system for obtaining response information during spill incidents, it is recommended that MCA be encouraged to expand their system to address hazardous waste materials. If the classification procedures and appropriate markings used during hazardous waste transportation, corresponding response information can be developed by industry and given to the operators of CHEMTREC. The spiller can identify the waste by the special marking and the operator can transmit the appropriate preliminary response information. The cooperation of CHEMTREC would be beneficial to the overall emergency response system since no new telephone number would be required. One source would be equipped to provide information on both pure chemicals and wastes, and the basic operational mechanism is already in effect.

Background Data Sources. At the present time, a large amount of information is being compiled by EPA to define hazardous waste streams. It is recommended that typical waste streams be evaluated with respect to their toxicity, detailed hazardous effects, and treatability for compilation into an appropriate background data source which will help emergency personnel determine the best way to handle a spill situation. It is possible that much of this information is already available from ongoing studies sponsored by the EPA Office of Solid Waste and need only be compiled into a single source for easy reference. With this information readily available, it will be much easier to establish the most effective mitigation procedures for waste spills.

Response Manuals. The complex nature of hazardous spill response makes the development of a single, comprehensive yet usable response manual extremely difficult. This problem was highlighted in the previously presented summaries and evaluations, since few of the sources reviewed attempted to consider the entire range of spill responses. Depending upon the stage of response, the audience addressed and the information presented by the response manuals can vary significantly. Therefore, it is recommended that two types of manuals be developed for control of hazardous waste spills: an initial response manual and a secondary response manual. The initial response manual presents methods for protecting human health and safety immediately after a spill occurrence. When possible, environmental protection procedures are also recommended. The initial response manual should be easy to use and present the needed information simply and clearly. The secondary response manual may consist of these volumes including containment methods, identification and assessment techniques, treatment and disposal methods. These manuals are directed to technical personnel and/or those who have been prepared through specialized training courses.

It is recommended that the initial response manual be prepared in a format similar to the DOT Hazardous Materials-Emergency Action Guide. A typical entry from this reference is shown in Figure 3. The main difference is that entries would be included corresponding to the hazardous waste stream categories previously established. The user of the manual could use the visible markings on the transporting vehicle to access the information included in the manual.

An example Table of Contents for this manual is included in Figure 4. The Preface should state the objectives of the manual itself, stressing that information presented is applicable to the first 2 hours after an incident and that detailed complete response information should be obtained elsewhere. A brief presentation of the classifications of waste would also



## Acrylonitrile

(Flammable, Thermally Unstable, Corrosive)

**Potential Hazards**

Fire
- Highly flammable.
- Flammable vapors may spread from spill.

Explosion
- Container may explode due to heat of fire.
- Runoff may create fire or explosion hazard in sewer system.

Health
- Contact may cause burns to skin and eyes.
- Runoff may pollute water supply.

**Immediate Action**

- Get helper and notify local authorities.
- If possible, wear self-contained breathing apparatus and full protective clothing.
- Eliminate all open flames. No smoking. No flares. Keep internal combustion engines *at least* 20 yards away from spill.
- Keep upwind and estimate *Immediate Danger Area.*
- Evacuate according to *Evacuation Table.*

**Immediate Follow-up Action**

Fire:
- **Small Fire:** Dry chemical or $CO_2$.
- **Large Fire:** Water spray or fog.
- Move containers from fire area if without risk.
- Cool containers with water from *maximum distance* until well after fire is out.
- For massive fire in cargo area, use unmanned hose holder or monitor nozzles.
- Stay away from ends of tanks.
- Withdraw immediately in case of rising sound from venting safety device.

Spill or Leak:
- Do not touch spilled liquid.
- Stop leak if without risk.
- Use water spray to reduce vapors.
- **Large Spills:** Dike for later disposal.
- **Small Spills:** Take up with sand, earth or other noncombustible, absorbent material.

First Aid
- Remove victim to fresh air. Call for emergency medical care. *Effects of contact or inhalation may be delayed.*
- If victim is not breathing, give artificial respiration. If breathing is difficult, give oxygen.
- If victim contacted material, immediately flush skin or eyes with running water *for at least 15 minutes.*
- Remove contaminated clothes.
- Keep victim warm and quiet.

Figure 3 . Typical entry from DOT's hazardous materials - emergency action guide (18).

**Additional Follow-up Action**

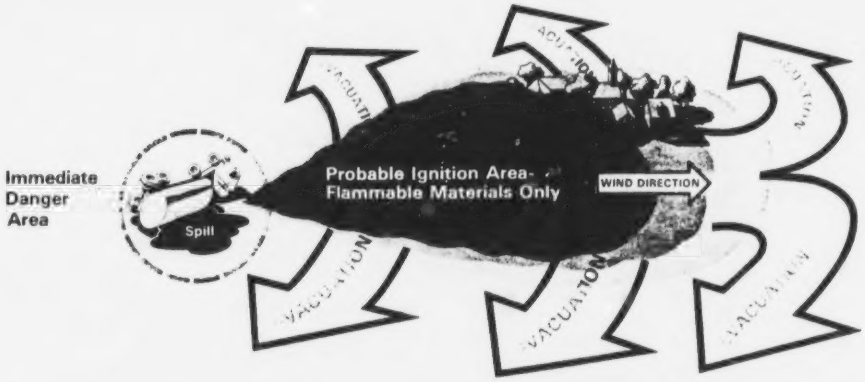
—For more detailed assistance in controlling the hazard, call Chemtrec (Chemical Transportation Emergency Center) toll free (800) 424-9300. You will be asked for the following information:

- Your location and phone number.
- Location of the accident.
- Name of product and shipper, if known.
- The color and number on any labels on the carrier or cargo.
- Weather conditions.
- Type of environment (populated, rural, business, etc.)
- Availability of water supply.

--Adjust evacuation area according to wind changes and observed effect on population.

**Water Pollution Control**

—Prevent runoff from fire control or dilution water from entering streams or drinking water supply. Dike for later disposal. Notify Coast Guard or Environmental Protection Agency of the situation through Chemtrec or your local authorities.


Immediate Danger Area
Spill
Probable Ignition Area-Flammable Materials Only
WIND DIRECTION
EVACUATION
EVACUATION
EVACUATION
EVACUATION
EVACUATION
EVACUATION

**Evacuation Table — Based on Prevailing Wind of 6-12 mph.**

| Approximate Size of Spill | Distance to Evacuate From Immediate Danger Area | For Maximum Safety, Downwind Evacuation Area Should Be |
|---|---|---|
| 200 square feet | 20 yards (24 paces) | 528 feet long, 528 feet wide |
| 400 square feet | 20 yards (24 paces) | 528 feet long, 528 feet wide |
| 600 square feet | 30 yards (36 paces) | 528 feet long, 528 feet wide |
| 800 square feet | 30 yards (36 paces) | 1,056 feet long, 528 feet wide |

In the event of an explosion, the minimum safe distance from flying fragments is 2,000 feet in all directions.

Figure 3 . (continued).

PREFACE
- a. Objectives
- b. Limitations
- c. Safety Considerations

CONTENTS

NOTIFICATION REQUIREMENTS AND OTHER AVAILABLE RESOURCES
- a. Summary of Legal Responsibility
- b. Appropriate Telephone Number
- c. Associated Information for Spill Response

SAFETY CONSIDERATIONS
- a. Hazards
- b. Protective Devices
    - 1. Clothing
    - 2. Breathing Apparatus
    - 3. Instrumentation

SPECIFIC WASTE CLASSIFICATION INFORMATION (by waste stream or category)
- a. Category or waste
    - 1. Name
    - 2. Summary of hazards
    - 3. Placard
    - 4. Potential hazards
        - -- Fire
        - -- Explosion
        - -- Health
        - -- Environment
    - 5. Immediate action
    - 6. Immediate follow-up action
        - -- Fire
        - -- Spill or leak
        - -- First aid
    - 7. Additional follow-up action
    - 8. Water/Land pollution control
- b. Other Waste Classifications

INITIAL CONTAINMENT TECHNIQUES
- a. Spills on Land
    - 1. Available method summary
        - -- Diking
        - -- Covering
        - -- Leak plugging

Figure 4. Proposed table of contents - initial response manual.

        2. Choosing methods of containment
        3. Directions to implement containment
        4. Safety hazards

    b. Spills in Water
        1. Available method summary

            -- Floating spills

                -- booms
                -- straw barriers
                -- other

            -- Mixing spills
            -- Sinking spills

        2. Choosing methods of containment

            -- Factors to consider
            -- Choice

        3. Directions to implement containment

        4. Safety hazards

Figure 4. (continued)

be desirable. Finally the Preface should stress the importance of safety for the initial response personnel and the need to be familiar with the contents of the manual prior to an actual spill incident.

A brief chapter summarizing the legal requirements for notification, presenting a notification procedure, and listing a brief description of other available resources providing information pertinent to hazardous waste spills should be next. This should be brief but include necessary information clearly and concisely.

Since initial spill response is potentially dangerous to the emergency personnel, a brief presentation of safety hazards and ways to minimize danger is appropriate in this manual. Again the chapter should be brief and illustrated. Safety hazards associated with identification of the load and initial containment should be stressed. Personnel protection equipment and appropriate air quality monitoring instrumentation can then be defined.

As much as possible, the basic data provided per entry should remain the same as that in the DOT manual including potential hazards; immediate action; immediate follow-up action; and additional follow-up action. The water pollution control section should be expanded to consider land spills more directly. Emphasis on potential groundwater contamination can be included.

In addition to these individual entries for each waste classification or stream, an illustrated presentation of immediate spill containment techniques is recommended. Since safe, immediate containment, or confinement of the spill to a limited area, could prevent the widespread adverse affects, this chapter is critical. Land and water spill techniques should be considered separately. First, available containment techniques should briefly described and illustrated. These techniques include placement of earthern dikes, covering or leak plugging for land spills or boom/barrier placement, air barriers and complete diversion for water spills. The water spill information may be further divided with regard to spills which float on water, sink, or mix into the water column. It is important to limit these techniques to those which can be implemented quickly, safely and easily with readily available materials. Specialized dikes or booms should be addressed as part of the secondary response manuals. The user should also be directed in choosing a containment technique and safely implementing it. The associated hazards should again be stressed as proper placement procedures are discussed.

This initial response manual would be directed to carriers and emergency response personnel. It could be utilized without a training session, although orientation would be helpful especially to emphasize safe application of the procedures. This manual would have broad distribution to almost anyone associated with hazardous waste transportation or handling.

In order to reduce the bulk of a single secondary response manual, it is recommended that this manual include three separate volumes: containment; identification and assessment; and treatment/disposal.

A recommended Table of Contents for Volume 1 - Containment is presented in Figure 5. The information included is much more detailed than that presented in the Initial Response Manual and can use more sophisticated equipment. This manual should be introduced by a section which emphasizes the need for containment to reduce the area impacted and allow response personnel time to establish the optimum control techniques. Since contain-

INTRODUCTION
- a. The Need for Containment
- b. Safety Hazards
- c. Advantages and Disadvantages

WATER SPILLS
- a. Floating Materials
  - 1. Techniques
    - -- Booms - types
      - - advantages and disadvantages where applicable
    - -- Fences
    - -- Weirs
    - -- Other
  - 2. Safety hazards
  - 3. Evaluating techniques
  - 4. Implementing procedures
- b. Mixing Materials
  - 1. Techniques
    - -- Diversion
    - -- Gelling
    - -- Total containment
    - -- Other
  - 2. Safety hazards
  - 3. Evaluating approaches
  - 4. Implementing procedures
- c. Sinking Materials
  - 1. Techniques
    - -- Excavation
    - -- Diking
    - -- Other
  - 2. Safety hazards
  - 3. Evaluation approaches
  - 4. Implementing procedures

LAND SPILLS
- a. Impermeable Soil
  - 1. Techniques

Figure 5. Proposed table of contents - secondary response manuals volume I - containment techniques.

-- Surface diking
-- Trenches
-- Gelling
-- Covering
-- Vapor suppression
-- Other

2. Safety hazards
3. Evaluating the approach
4. Implementing procedures

b. Permeable Soil
1. Techniques

-- Grouting
-- Wall barriers
-- Gelling in-situ
-- Excavation
-- Covering
-- Vapor suppression
-- Other

2. Safety hazards
3. Evaluating the approach
4. Implementing procedures

MATERIALS REQUIRED
a. Readily Available
1. Types
2. Where available

b. To Be Stocked
1. Types
2. Common vendors

Figure 5. (continued).

ment can be the most dangerous aspect of spill response, the safety hazards must be stressed along with a general presentation on safety equipment. Finally, the potential disadvantages of spill containment should be considered. For example, containment of the spill could concentrate the problem and cause more long term environmental damage than dilution and in-situ (in place) treatment.

Detailed information regarding spills on land and in water can be presented separately. Spills affecting water must be grouped into those which float, sink or mix in order to address containment in depth. The techniques presented in the EPA Manual for the Control of Hazardous Materials Spills - Volume I, should be expanded with emphasis on the safe way to implement the procedures.

Each category should first identify available or new methods for containment of a specified spill type. The discussion should illustrate the technique and explain its strengths and limitations. The potential safety hazards should be discussed along with a brief approach to choosing the appropriate technique. Safe implementation procedures can then be included with examples illustrations.

The various containment techniques mentioned in Figure 4 are a preliminary listing of procedures which should be included in the manual. Other applicable procedures, identified through research should be added.

The final section should address the materials which will be required to actually contain the spill. These can be divided into equipment which is readily available at local hardware stores or treatment plants, and that which should be obtained prior to a spill and stockpiled. Both types and sources of material should be presented.

It is important to note at this point, that containment techniques are established by the behavior of the material rather than by its specific identity. Therefore, containment procedures for virgin spills are similar to those for spills of hazardous wastes. The only information required to access a manual on containment techniques is a visual observation of the situation or a key in the initial response manual which indicates the wastes behavior with water (sink, float, mix).

The second volume should address identification and assessment of human danger potential associated with the hazardous waste spill. A proposed Table of Contents is presented in Figure 6. The first section should outline the objective of the manual which is to present procedures which will allow the safe identification and assessment of the danger associated with hazardous waste spills. The audience is basically technical, although the manual can be organized in a manner which allows the technical coordinator or OSC to direct on site emergency response personnel in obtaining information.

Identification of hazardous wastes can be extremely difficult if mixtures are involved in the spill. The degree of difficulty will partly be established by the amount of information available on the bill of lading and that which has been compiled separately and is readily accessible to response personnel. If it is assumed that the waste classification and compilation of background information has been accomplished, the format presented in this report can be employed.

Since the initial stages of response require emergency personnel to deal with an unknown material, the safety hazards are extensive. Instruc-

INTRODUCTION

- a. Objectives
- b. Audience Addressed

IDENTIFICATION TECHNIQUES

- a. Discussion of Potential Safety Hazards
- b. Markings (corresponding to waste classification)
- c. Shipping Papers
    - 1. Truck transport
    - 2. Train transport
    - 3. Other

- d. Background Records
    - 1. Copies of shipping papers - where/how access
    - 2. Sources(s) of waste - (from industry)
    - 3. Typical waste stream compositions
    - 4. Other

- e. Physical Properties (if possible)
    - 1. Types to consider
    - 2. How to observe
    - 3. Ways to identify materials

- f. Laboratory Testing
    - 1. Sampling methods
    - 2. Testing procedures

        -- Organics
        -- Inorganics

ASSESSMENT

- a. Interrelationships with CHRIS
- b. Needed additional information
- c. Site specific information
    - 1. Volume spilled
    - 2. Rate of discharge
    - 3. Location of spill

        -- Media
        -- Populations
        -- Area/volume affected
        -- Condition of source
        -- Meteorological conditions
        -- Size of source

Figure 6. Proposed table of contents - secondary response manuals volume II - identification and assessment.

d. Interpretation of information coordinator

   1. Development of needed inputs to the assessment system

   2. Outputs available

      -- Vapor cloud travel
      -- Water plume travel
      -- Explosion danger
      -- Distance of Flammability hazard

   3. Recommended secondary action

Figure 6. (continued).

tions must direct emergency response personnel to deal with the spilled waste as if it were extremely hazardous until a positive identification can be made. The safety hazards associated with direct contact, inhalation or skin adsorption should be explained. Preliminary identification can be done using the markings on the transporting vehicle or, if accessible, labels on containers. These markings could correspond to waste stream and/or hazard type. The general markings will allow effective initial response, however, total clean-up will require knowledge of the component identities. The methods to perform a more complete identification from markings should be included.

It may be possible to use shipping papers to identify waste stream components, depending upon what is legally required to be included on these documents. An example of a typical document and information regarding their location on the vehicle should be included so that on site personnel can obtain the needed information. Identification can also be established through reference to copies of shipping papers or documentation of waste streams by industry. Examples and instruction regarding ways to obtain and use this information should be included. The composition of typical waste streams should be presented for quick reference.

If possible, identification procedures using the physical properties should be included. These may be limited to "pure" hazardous wastes rather than mixtures due to the difficulties associated with identification in a mixed system. When physical properties are to be identified, the manual should include instructions on safe ways to observe these properties and methods to perform the actual identification. When direct physical property observation will not result in positive identification, laboratory testing may be needed. The manual should discuss sampling methods as well as testing procedures for both organic and inorganic wastes.

The assessment information should be patterned after that presented in CHRIS - Volume 3. A similar approach should be utilized but expanded to address hazardous waste materials and spills onto land. If possible, information already presented in CHRIS should be referenced so that duplication is minimized. The first section can discuss possible interrelationships with the existing systems and then identify the areas which have been modified.

The next chapter should outline the information needed from the spill site. Directions should include the information needed by on scene personnel in order to obtain the site specific data. Then instructions to the coordinator can be included to allow interpretation of the information for input to the assessment system. Directions for use of the outputs with regard to secondary action such as evacuation, access restriction etc. should be included.

The final volume of the secondary response manuals for handling hazardous waste spills should present clean-up and disposal techniques. This manual must be comprehensive and offer the user a procedure for establishing the most feasible technique for handling a hazardous waste spills. A set approach is not always the best due to site specific limitations. In some cases, the actual treatment of hazardous waste spills may not be the most feasible way to handle these materials in any situation. One of the first steps in the response would be to assess typical modes of transportation and distances to acceptable disposal sites which will establish the economics of on site treatment as opposed to direct excavation. A recommended Table of Contents for this manual is included in Figure 7.

The manual should begin with a brief presentation of its objective and limitations. It should be emphasized at this point that the other manuals and background information sources should be used as reference throughout the manual's application. The objective itself is to present a clear description of treatment and disposal options applicable to hazardous waste spill handling and to establish a procedure for identification of the most viable technique.

The manual would be quite technical and should have a limited distribution. It should be available to Federal OSCs and their technical advisors. Due to the nature of the manual, an associated training program would be desirable. The program could be about one week long and include detailed instructions on the manuals use and limitations. Simulation exercises would be desirable.

The next section should be devoted to determining the best method for handling a spill. The options can include hauling the affected media directly to disposal, in-situ (in place) treatment or off-stream treatment. The advantages of these general procedures and the critical variables for establishing their usefulness can be identified. Then the manual should present a procedure for evaluating the specific incident and determining the best control technology.

The general treatment techniques can then be discussed. The section should present 1) an overview of the process, 2) a brief indication of which waste streams should be handled by that technique and 3) various methods for process implementation (in-situ, off stream but on site, or off stream at the disposal site). Because of the complex nature of wastes, unusual treatment systems such as calcination, dissolution or evaporation may be included as potential treatment processes. The chapter should also include a brief presentation on how to reduce the volumes of wastes transported by various solids dewatering techniques.

In order to establish the most applicable treatment process by waste stream, small scale treatability testing will be needed. As much as possible, the appropriate treatment processes for each waste stream can be identified. However, sometimes it is not possible to generalize and chemical dosages are always specific to the spill incident. This chapter should also present methods for scale-up from laboratory to full size and for establishing treatment flow rates.

Implementation of the treatment processes must also be addressed. First the available equipment should be identified. This can be specialty systems built for spill response or improvised treatment equipment constructed using off the shelf materials. For improvised water treatment units, the users should be referred to the EPA Manual for Control of Hazardous Materials Spills - Volume I. Implementation should be considered separately for both land and water spills.

The final chapter should address disposal techniques. These can include incineration, pyrolyses, land disposal, encapsulation, etc. The manual should present a method for evaluating the procedures and choosing the best one. If possible, typical techniques for waste streams can be listed. The manual should also include a sample listing of available

INTRODUCTION
- a. Objectives and Limitations
- b. Audience Addressed

DETERMINATION OF BEST CONTROL TECHNIQUES
- a. Presentation of Options
- b. Identification of Critical Variables
- c. Evaluation of Specific Situation
- d. Choice of Control Technology

IMPLEMENTATION OF TREATMENT SYSTEMS
- a. General Treatment Methods Available
  - 1. Process
  - 2. Typical waste streams
  - 3. Treatment modes

      -- In-situ
      -- Off stream/on-site
      -- Off stream/disposal site

  - 4. Dewatering Procedure

- b. Determining Appropriate Treatment Methods
  - 1. Common types by waste stream
  - 2. Verification by treatability tests
  - 3. Scale-up
  - 4. Establishing treatment flow rates

- c. Implementing Treatment Techniques
  - 1. Types of available equipment

      -- Improvised equipment
      -- Specialty systems

  - 2. Land spills
  - 3. Water spills

DISPOSAL
- a. Methods
- b. Choosing the Best Method
  - 1. Variables involved
  - 2. Evaluation

- c. Typical Techniques per Waste Stream
- d. Available Sites
- e. Implementation

Figure 7. Proposed table of contents - secondary response manuals volume III - treatment and disposal.

disposal sites and their treatment capabilities. Implementation considerations can involve safe loading, transport and handling of the wastes prior to ultimate disposal.

In summary, the four recommended response manuals must be used in conjunction with background information on hazardous waste to be most effective. Associated training courses are desirable since they insure that the user is somewhat familiar with the manual contents before the spill incident. The emphasis has been placed on identification of the hazardous waste prior to any response. This identification may be preliminary from markings but it must be refined prior to effective complete response. Unfortunately few available manuals are applicable to use with mixtures of hazardous wastes, so little introduction is feasible. It should be noted however, that the containment techniques are independent of chemical type (waste or pure) and this manual could be developed separately.

Response Teams. Of the three types of response groups: government sponsored, industrial sponsored or third party contractor, the last group is best equipped at this time to handle hazardous waste spills. However, no response team can function effectively without technical resources and background information regarding the spilled material. It is recommended that all three groups develop the capabilities for handling hazardous wastes associated with the production or transportation of pure materials. This should not be a serious problem once the technical background information is available. If the various groups are willing to cooperate, all emergency response to hazardous material spills (including wastes) can be coordinated through available teams. The development of a separate team to respond to hazardous waste spills is not recommended.

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# APPENDIX A

## BACKGROUND INFORMATION

CONTENTS PAGE

TABLE

A-1 Source - Listing for Various Response Systems A-4

FIGURE

A-1 Typical Entry from Dangerous Properties of Industrial Materials (6) A-8
A-2 Table of Contents from Dangerous Properties of Industrial Materials (6) A-9
A-3 Table of Contents from the Merck Index (7) A-10
A-4 Typical Entry from the Merck Index (7) A-11
A-5 Explanatory Notes from the Merck Index (7) A-12
A-6 Explanatory Notes from Toxic and Hazardous Industrial Chemicals Safety Manual (8) A-16
A-7 Typical Entry from Toxic and Hazardous Industrial Chemicals Safety Manual (8) A-17
A-8 Table of Contents from Chemistry of Hazardous Materials (10) A-18
A-9 Table of Contents from the Fire Officers Guide to Dangerous Chemicals (11) A-21
A-10 Table of Contents from Hazardous Materials (12) A-22
A-11 Typical Entry from Emergency Handling of Hazardous Materials in Surface Transportation (13) A-23

CONTENTS (continued)

PAGE

A-12 Table of Contents from *Guide Lines to the Handling of Hazardous Materials* (14) A-25

A-13 General Explanation from *Guide Lines to the Handling of Hazardous Materials* (14) A-26

A-14 Typical Entries from *Guide Lines to the Handling of Hazardous Materials* (14) A-27

A-15 Typical Listing from the *Hazardous Materials Handbook* (15) A-28

A-16 Table of Contents from the *Hazardous Materials Safety Manual* (16) A-29

A-17 Typical entry from the *Hazardous Materials Safety Manual* (16) A-30

A-18 Table of Contents - *National Fire Codes* - Volume 3 (17) A-32

A-19 Typical Entry - *National Fire Codes* - Volume 3 (17) A-34

A-20 Typical Entry from *Hazardous Materials - Emergency Action Guide* (18) A-36

A-21 Example Tremcard (22) A-38

A-22 Typical Entry from *CHRIS Volume 1* (23) A-39

A-23 Typical Entry from *CHRIS Volume 2* (23) A-40

A-24 Listing of Subject Headings for OHMTADS (24) A-42

A-25 Table of Contents from *Manual for Control of Hazardous Material Spills* - Volume 1 (25) A-45

A-26 Typical Listing from the *Laboratory Disposal Manual* (29) A-48

A-27 An Example of an MCA Chem-Card - Transportation Emergency Guide (20) A-49

A-28 An Example of a Cargo Information Card (20) A-50

# CONTENTS (continued)

PAGE

A-29 A Typical Entry from Section 1: Flash Point Index of Trade Names of the *Fire Protection Guide on Hazardous Materials* (21) A-51

A-30 A Typical Entry from Section 2: Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids of the *Fire Protection Guide on Hazardous Materials* (21) A-52

A-31 U.S. Department of Transportation Guide for Preparing Hazardous Materials Incident Reports A-53

A-32 State of Wisconsin Toxic and Hazardous Incident Report Form A-55

TABLE A-1 SOURCE-LISTING FOR VARIOUS RESPONSE SYSTEMS

| RESPONSE MANUAL OR INFORMATION SOURCE REVIEWED | SOURCE |
|---|---|
| 1. Dangerous Properties of Industrial Materials - N. Irving Sax, ed. | Van Nostrand Reinhold Publishing Co.<br>New York, New York |
| 2. The Merck Index - M. Windholz, ed. | Merck and Company, Inc.<br>Rahway, New Jersey |
| 3. Toxic and Hazardous Industrial Chemicals Safety Manual | The International Technical Info. Institute, Toranomon-Tachikawa Bldg.6-5.1 Chrome, Nishi-Shimbashi, Minato-Ku<br>Tokyo, Japan |
| 4. Chemical Safety Data Sheets | Manufacturing Chemists Association<br>1825 Connecticut Avenue<br>Washington, D.C. 20009 |
| 5. Chemistry of Hazardous Materials, E. Meyer | Prentice Hall, Inc.<br>Englewood Cliffs, New Jersey |
| 6. Fire Officers Guide to Dangerous Chemicals - C.W. Bahme | National Fire Protection Association<br>Publications Department<br>470 Atlantic Ave.<br>Boston, Mass. 02210 |
| 7. Hazardous Materials - L. Schieles and D. Pauze | Van Nostrand Reinhold Publishing Co.<br>New York, New York |

TABLE A-1 (continued)

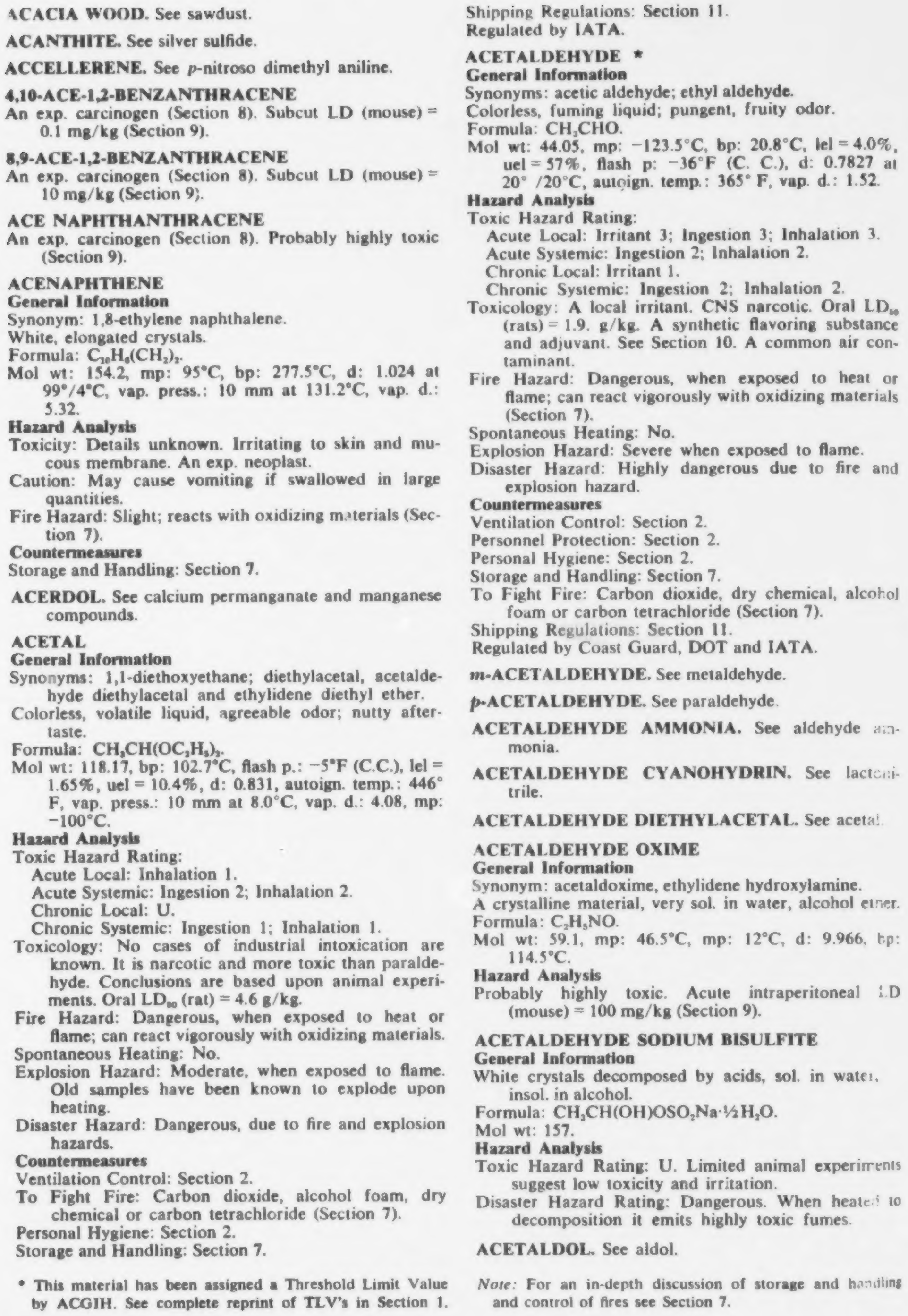
| RESPONSE MANUAL OR INFORMATION SOURCE REVIEWED | SOURCE |
|---|---|
| 8. Emergency Handling of Hazardous Materials in Surface Transportation | Bureau of Explosives, Amer.Ass. of RR<br>**1920 L Street**<br>Washington, D.C. 20036 |
| 9. Guidelines to the Handling of Hazardous Materials - D.J. Behrendsen | Source of Safety, Inc.<br>8303 E. Kenyon Drive<br>Denver, Colorado 80237 |
| 10. Hazardous Materials Handbook - J.H. Meidl | Glencoe Press<br>Beverly Hills, Calif. |
| 11. National Fire Codes - Volume 3, Combustible Solids, Dusts and Explosives | National Fire Protection Association<br>Publications Department<br>470 Atlantic Ave.<br>Boston, Mass. 02210 |
| 12. Hazardous Materials - Emergency Action Guide | U.S. Department of Transportation<br>Materials Transportation Bureau MT H-21<br>Office of Hazardous Materials Operations<br>2100 Second Street, SW.<br>Washington, D.C. 20590 |
| 13. Chem-cards | Manufacturing Chemists Association<br>1825 Connecticut Avenue<br>Washington, D.C. 20009 |

TABLE A-1 (continued)

| RESPONSE MANUAL OR INFORMATION SOURCE REVIEWED | SOURCE |
|---|---|
| 14. Guide on Hazardous Materials | National Fire Protection Association<br>Publications Department<br>470 Atlantic Ave.<br>Boston, Mass. 02210 |
| 15. Transportation Emergency Cards (Tremcards) | Redland Purle Limited<br>Claydons Lane<br>Rayleigh, Essex<br>England |
| 16. Chemical Hazards Response Information Systems (CHRIS) Manuals | Superintendent of Documents<br>U.S. Government Printing Office<br>Washington, D.C. 20402 |
| 17. Manual for Control of Hazardous Material Spills - Volume 1 | U.S. Department of Commerce<br>National Technical Information Service<br>Order Number PB-276 734/1WP<br>5285 Port Royal Road<br>Springfield, Va. 22161 |
| 18. Field Detection and Damage Assessment Manual for Oil and Hazardous Material Spills. | Environmental Protection Agency<br>Division of Oil and Hazardous Materials<br>Washington, D.C. |
| 19. Chemical Disposal Techniques for Hazardous Materials | United Parcel Service<br>Contact local office for help |

TABLE A-1 (continued)

| RESPONSE MANUAL OR INFORMATION SOURCE REVIEWED | SOURCE |
|---|---|
| 20. Laboratory Waste Disposal Manual | Manufacturing Chemists Association<br>1825 Connecticut Ave.<br>Washington, D.C. 20009 |
| 21. Recommended Methods of Reduction, Neutralization, Recovery or Disposal of Hazardous Waste | U.S. Department of Commerce<br>National Technical Info. Service<br>Order Number PB-224580<br>5285 Port Royal Road<br>Springfield, Va. 22161 |



**ACACIA WOOD.** See sawdust.

**ACANTHITE.** See silver sulfide.

**ACCELLERENE.** See *p*-nitroso dimethyl aniline.

**4,10-ACE-1,2-BENZANTHRACENE**
An exp. carcinogen (Section 8). Subcut LD (mouse) = 0.1 mg/kg (Section 9).

**8,9-ACE-1,2-BENZANTHRACENE**
An exp. carcinogen (Section 8). Subcut LD (mouse) = 10 mg/kg (Section 9).

**ACE NAPHTHANTHRACENE**
An exp. carcinogen (Section 8). Probably highly toxic (Section 9).

**ACENAPHTHENE**
**General Information**
Synonym: 1,8-ethylene naphthalene.
White, elongated crystals.
Formula: $C_{10}H_6(CH_2)_2$.
Mol wt: 154.2, mp: 95°C, bp: 277.5°C, d: 1.024 at 99°/4°C, vap. press.: 10 mm at 131.2°C, vap. d.: 5.32.
**Hazard Analysis**
Toxicity: Details unknown. Irritating to skin and mucous membrane. An exp. neoplast.
Caution: May cause vomiting if swallowed in large quantities.
Fire Hazard: Slight; reacts with oxidizing materials (Section 7).
**Countermeasures**
Storage and Handling: Section 7.

**ACERDOL.** See calcium permanganate and manganese compounds.

**ACETAL**
**General Information**
Synonyms: 1,1-diethoxyethane; diethylacetal, acetaldehyde diethylacetal and ethylidene diethyl ether.
Colorless, volatile liquid, agreeable odor; nutty aftertaste.
Formula: $CH_3CH(OC_2H_5)_2$.
Mol wt: 118.17, bp: 102.7°C, flash p.: −5°F (C.C.), lel = 1.65%, uel = 10.4%, d: 0.831, autoign. temp.: 446° F, vap. press.: 10 mm at 8.0°C, vap. d.: 4.08, mp: −100°C.
**Hazard Analysis**
Toxic Hazard Rating:
  Acute Local: Inhalation 1.
  Acute Systemic: Ingestion 2; Inhalation 2.
  Chronic Local: U.
  Chronic Systemic: Ingestion 1; Inhalation 1.
Toxicology: No cases of industrial intoxication are known. It is narcotic and more toxic than paraldehyde. Conclusions are based upon animal experiments. Oral $LD_{50}$ (rat) = 4.6 g/kg.
Fire Hazard: Dangerous, when exposed to heat or flame; can react vigorously with oxidizing materials.
Spontaneous Heating: No.
Explosion Hazard: Moderate, when exposed to flame. Old samples have been known to explode upon heating.
Disaster Hazard: Dangerous, due to fire and explosion hazards.
**Countermeasures**
Ventilation Control: Section 2.
To Fight Fire: Carbon dioxide, alcohol foam, dry chemical or carbon tetrachloride (Section 7).
Personal Hygiene: Section 2.
Storage and Handling: Section 7.
Shipping Regulations: Section 11.
Regulated by IATA.

**ACETALDEHYDE** *
**General Information**
Synonyms: acetic aldehyde; ethyl aldehyde.
Colorless, fuming liquid; pungent, fruity odor.
Formula: $CH_3CHO$.
Mol wt: 44.05, mp: −123.5°C, bp: 20.8°C, lel = 4.0%, uel = 57%, flash p: −36°F (C. C.), d: 0.7827 at 20° /20°C, autoign. temp.: 365° F, vap. d.: 1.52.
**Hazard Analysis**
Toxic Hazard Rating:
  Acute Local: Irritant 3; Ingestion 3; Inhalation 3.
  Acute Systemic: Ingestion 2; Inhalation 2.
  Chronic Local: Irritant 1.
  Chronic Systemic: Ingestion 2; Inhalation 2.
Toxicology: A local irritant. CNS narcotic. Oral $LD_{50}$ (rats) = 1.9. g/kg. A synthetic flavoring substance and adjuvant. See Section 10. A common air contaminant.
Fire Hazard: Dangerous, when exposed to heat or flame; can react vigorously with oxidizing materials (Section 7).
Spontaneous Heating: No.
Explosion Hazard: Severe when exposed to flame.
Disaster Hazard: Highly dangerous due to fire and explosion hazard.
**Countermeasures**
Ventilation Control: Section 2.
Personnel Protection: Section 2.
Personal Hygiene: Section 2.
Storage and Handling: Section 7.
To Fight Fire: Carbon dioxide, dry chemical, alcohol foam or carbon tetrachloride (Section 7).
Shipping Regulations: Section 11.
Regulated by Coast Guard, DOT and IATA.

***m*-ACETALDEHYDE.** See metaldehyde.

***p*-ACETALDEHYDE.** See paraldehyde.

**ACETALDEHYDE AMMONIA.** See aldehyde ammonia.

**ACETALDEHYDE CYANOHYDRIN.** See lactonitrile.

**ACETALDEHYDE DIETHYLACETAL.** See acetal.

**ACETALDEHYDE OXIME**
**General Information**
Synonym: acetaldoxime, ethylidene hydroxylamine.
A crystalline material, very sol. in water, alcohol ether.
Formula: $C_2H_5NO$.
Mol wt: 59.1, mp: 46.5°C, mp: 12°C, d: 9.966, bp: 114.5°C.
**Hazard Analysis**
Probably highly toxic. Acute intraperitoneal LD (mouse) = 100 mg/kg (Section 9).

**ACETALDEHYDE SODIUM BISULFITE**
**General Information**
White crystals decomposed by acids, sol. in water, insol. in alcohol.
Formula: $CH_3CH(OH)OSO_2Na \cdot \frac{1}{2}H_2O$.
Mol wt: 157.
**Hazard Analysis**
Toxic Hazard Rating: U. Limited animal experiments suggest low toxicity and irritation.
Disaster Hazard Rating: Dangerous. When heated to decomposition it emits highly toxic fumes.

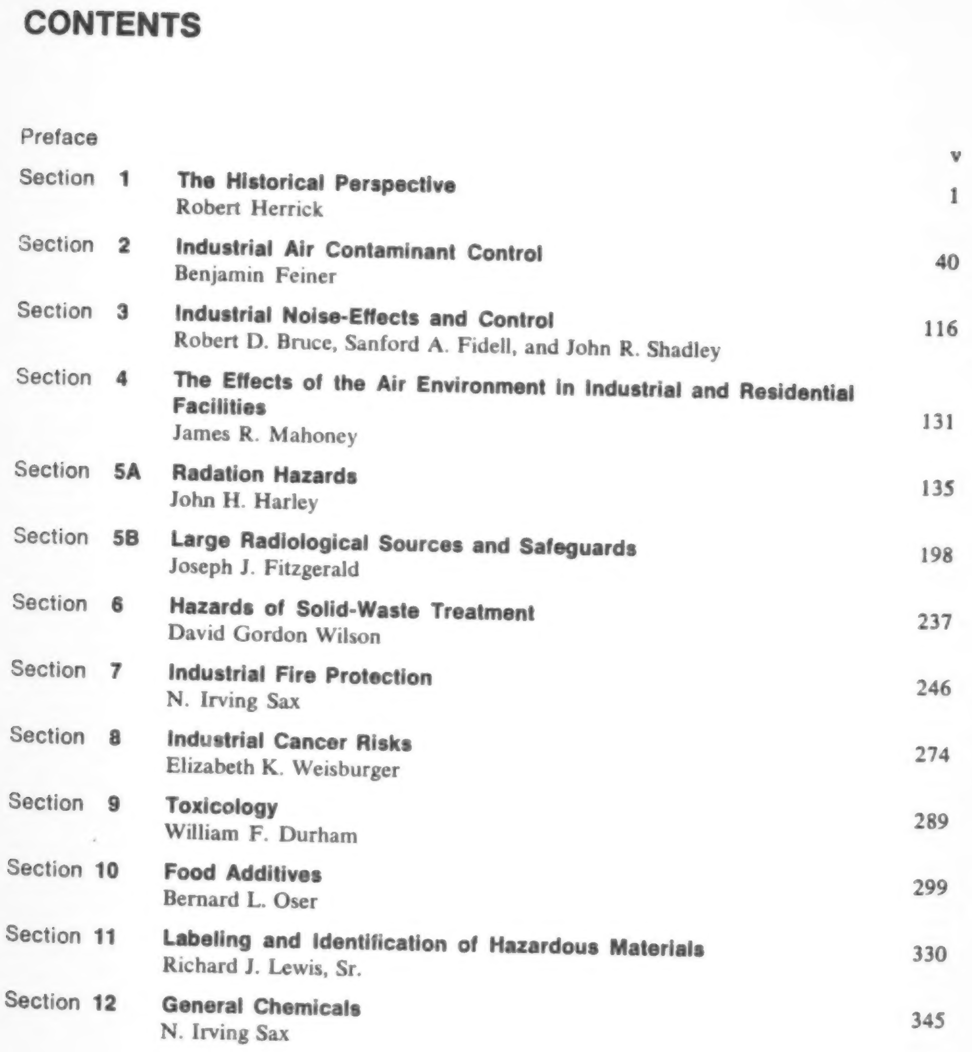
**ACETALDOL.** See aldol.

---

* **This material has been assigned a Threshold Limit Value by ACGIH. See complete reprint of TLV's in Section 1.**

*Note:* **For an in-depth discussion of storage and handling and control of fires see Section 7.**

Figure A-1. Typical entry from Dangerous Properties of Industrial Materials (6).



## CONTENTS

Preface v

Section 1 **The Historical Perspective** 1
Robert Herrick

Section 2 **Industrial Air Contaminant Control** 40
Benjamin Feiner

Section 3 **Industrial Noise-Effects and Control** 116
Robert D. Bruce, Sanford A. Fidell, and John R. Shadley

Section 4 **The Effects of the Air Environment in Industrial and Residential Facilities** 131
James R. Mahoney

Section 5A **Radiation Hazards** 135
John H. Harley

Section 5B **Large Radiological Sources and Safeguards** 198
Joseph J. Fitzgerald

Section 6 **Hazards of Solid-Waste Treatment** 237
David Gordon Wilson

Section 7 **Industrial Fire Protection** 246
N. Irving Sax

Section 8 **Industrial Cancer Risks** 274
Elizabeth K. Weisburger

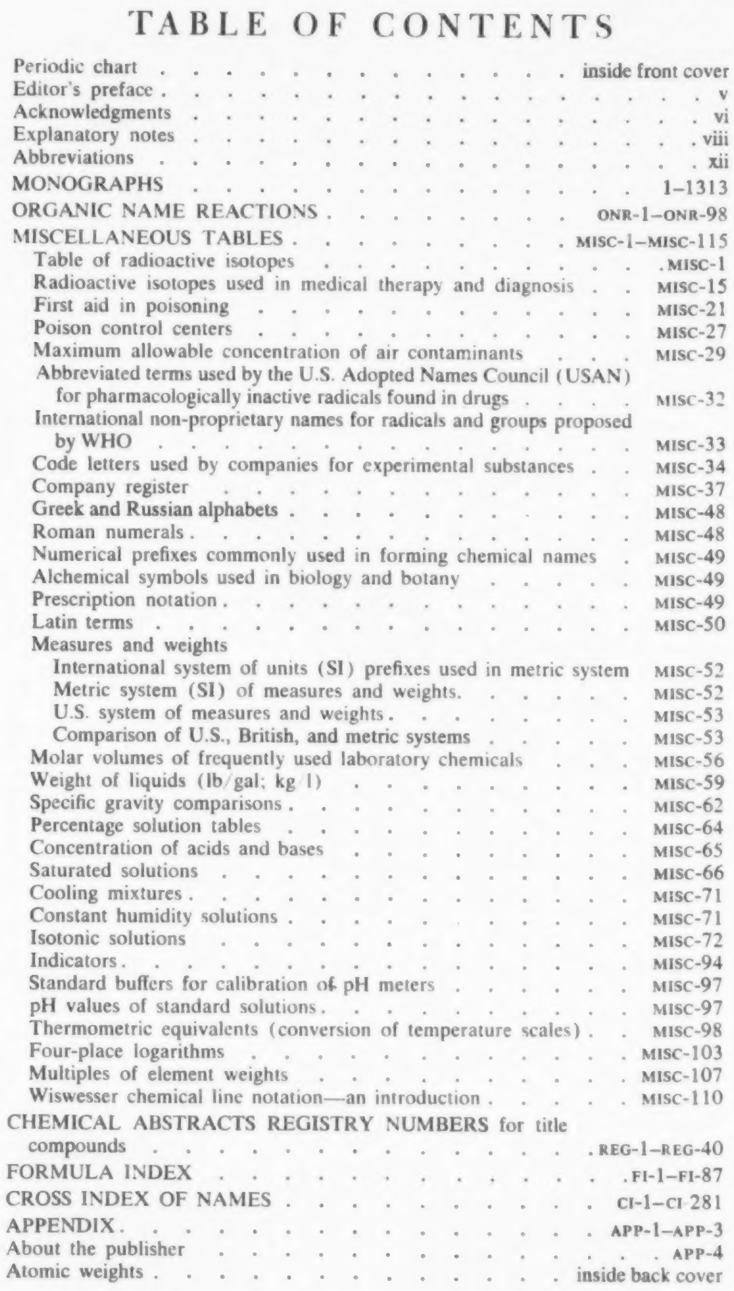
Section 9 **Toxicology** 289
William F. Durham

Section 10 **Food Additives** 299
Bernard L. Oser

Section 11 **Labeling and Identification of Hazardous Materials** 330
Richard J. Lewis, Sr.

Section 12 **General Chemicals** 345
N. Irving Sax

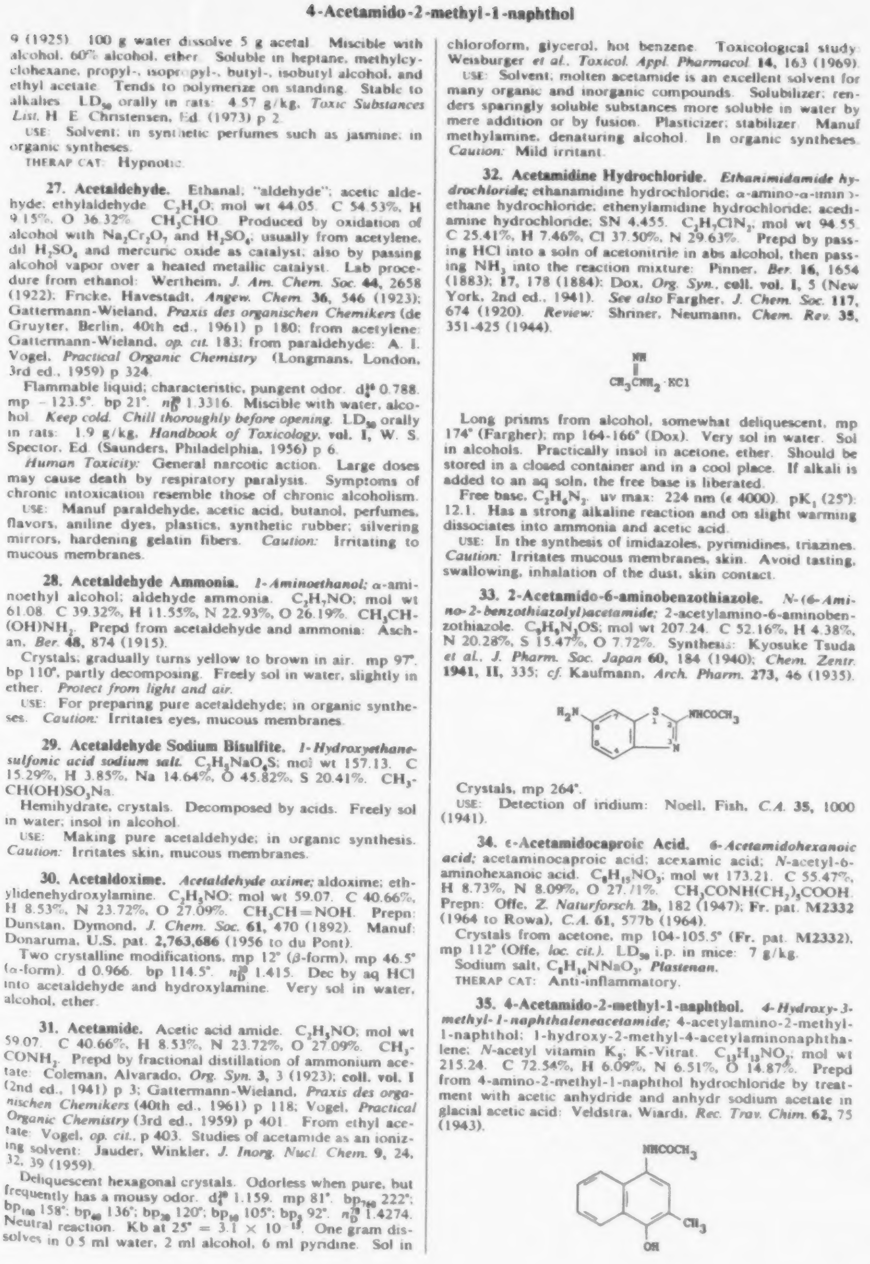
Figure A-2. Table of contents from Dangerous Properties of Industrial Materials (6).



## TABLE OF CONTENTS

Periodic chart . . . . . . . . . . . . . . . . inside front cover
Editor's preface . . . . . . . . . . . . . . . . . . . . v
Acknowledgments . . . . . . . . . . . . . . . . . . . vi
Explanatory notes . . . . . . . . . . . . . . . . . . viii
Abbreviations . . . . . . . . . . . . . . . . . . . xii
MONOGRAPHS . . . . . . . . . . . . . . . . 1–1313
ORGANIC NAME REACTIONS . . . . . . . . . ONR-1–ONR-98
MISCELLANEOUS TABLES . . . . . . . . . . MISC-1–MISC-115
  Table of radioactive isotopes . . . . . . . . . . . MISC-1
  Radioactive isotopes used in medical therapy and diagnosis . . MISC-15
  First aid in poisoning . . . . . . . . . . . . . MISC-21
  Poison control centers . . . . . . . . . . . . . MISC-27
  Maximum allowable concentration of air contaminants . . . MISC-29
  Abbreviated terms used by the U.S. Adopted Names Council (USAN) for pharmacologically inactive radicals found in drugs . . . . MISC-32
  International non-proprietary names for radicals and groups proposed by WHO . . . . . . . . . . . . . . . MISC-33
  Code letters used by companies for experimental substances . . MISC-34
  Company register . . . . . . . . . . . . . . . MISC-37
  Greek and Russian alphabets . . . . . . . . . . . . MISC-48
  Roman numerals . . . . . . . . . . . . . . . . MISC-48
  Numerical prefixes commonly used in forming chemical names . MISC-49
  Alchemical symbols used in biology and botany . . . . . MISC-49
  Prescription notation . . . . . . . . . . . . . . MISC-49
  Latin terms . . . . . . . . . . . . . . . . . MISC-50
  Measures and weights
    International system of units (SI) prefixes used in metric system MISC-52
    Metric system (SI) of measures and weights. . . . . . MISC-52
    U.S. system of measures and weights. . . . . . . . . MISC-53
    Comparison of U.S., British, and metric systems . . . . . MISC-53
  Molar volumes of frequently used laboratory chemicals . . . MISC-56
  Weight of liquids (lb/gal; kg/l) . . . . . . . . . . MISC-59
  Specific gravity comparisons . . . . . . . . . . . . MISC-62
  Percentage solution tables . . . . . . . . . . . . MISC-64
  Concentration of acids and bases . . . . . . . . . . MISC-65
  Saturated solutions . . . . . . . . . . . . . . MISC-66
  Cooling mixtures . . . . . . . . . . . . . . . MISC-71
  Constant humidity solutions . . . . . . . . . . . . MISC-71
  Isotonic solutions . . . . . . . . . . . . . . . MISC-72
  Indicators . . . . . . . . . . . . . . . . . . MISC-94
  Standard buffers for calibration of pH meters . . . . . . MISC-97
  pH values of standard solutions . . . . . . . . . . MISC-97
  Thermometric equivalents (conversion of temperature scales) . . MISC-98
  Four-place logarithms . . . . . . . . . . . . . . MISC-103
  Multiples of element weights . . . . . . . . . . . MISC-107
  Wiswesser chemical line notation—an introduction . . . . . MISC-110
CHEMICAL ABSTRACTS REGISTRY NUMBERS for title compounds . . . . . . . . . . . . . . . . . REG-1–REG-40
FORMULA INDEX . . . . . . . . . . . . . . . FI-1–FI-87
CROSS INDEX OF NAMES . . . . . . . . . . . . CI-1–CI-281
APPENDIX . . . . . . . . . . . . . . . . . APP-1–APP-3
About the publisher . . . . . . . . . . . . . . . . APP-4
Atomic weights . . . . . . . . . . . . . . . . inside back cover

Figure A-3. Table of contents from the Merck Index (7).



9 (1925). 100 g water dissolve 5 g acetal. Miscible with alcohol, 60% alcohol, ether. Soluble in heptane, methylcyclohexane, propyl-, isopropyl-, butyl-, isobutyl alcohol, and ethyl acetate. Tends to polymerize on standing. Stable to alkalies. $LD_{50}$ orally in rats: 4.57 g/kg, *Toxic Substances List*, H. E. Christensen, Ed. (1973) p 2.

USE: Solvent; in synthetic perfumes such as jasmine; in organic syntheses.

THERAP CAT: Hypnotic.

**27. Acetaldehyde.** Ethanal; "aldehyde"; acetic aldehyde; ethylaldehyde. $C_2H_4O$; mol wt 44.05. C 54.53%, H 9.15%, O 36.32%. $CH_3CHO$. Produced by oxidation of alcohol with $Na_2Cr_2O_7$ and $H_2SO_4$; usually from acetylene, dil $H_2SO_4$ and mercuric oxide as catalyst; also by passing alcohol vapor over a heated metallic catalyst. Lab procedure from ethanol: Wertheim, *J. Am. Chem. Soc.* **44**, 2658 (1922); Fricke, Havestadt, *Angew. Chem.* **36**, 546 (1923); Gattermann-Wieland, *Praxis des organischen Chemikers* (de Gruyter, Berlin, 40th ed., 1961) p 180; from acetylene: Gattermann-Wieland, *op. cit.* 183; from paraldehyde: A. I. Vogel, *Practical Organic Chemistry* (Longmans, London, 3rd ed., 1959) p 324.

Flammable liquid; characteristic, pungent odor. $d_4^{16}$ 0.788. mp −123.5°. bp 21°. $n_D^{20}$ 1.3316. Miscible with water, alcohol. *Keep cold. Chill thoroughly before opening.* $LD_{50}$ orally in rats: 1.9 g/kg, *Handbook of Toxicology*, **vol. I**, W. S. Spector, Ed. (Saunders, Philadelphia, 1956) p 6.

*Human Toxicity:* General narcotic action. Large doses may cause death by respiratory paralysis. Symptoms of chronic intoxication resemble those of chronic alcoholism.

USE: Manuf paraldehyde, acetic acid, butanol, perfumes, flavors, aniline dyes, plastics, synthetic rubber; silvering mirrors, hardening gelatin fibers. *Caution:* Irritating to mucous membranes.

**28. Acetaldehyde Ammonia.** *1-Aminoethanol;* α-aminoethyl alcohol; aldehyde ammonia. $C_2H_7NO$; mol wt 61.08. C 39.32%, H 11.55%, N 22.93%, O 26.19%. $CH_3CH(OH)NH_2$. Prepd from acetaldehyde and ammonia: Aschan, *Ber.* **48**, 874 (1915).

Crystals; gradually turns yellow to brown in air. mp 97°. bp 110°, partly decomposing. Freely sol in water, slightly in ether. *Protect from light and air.*

USE: For preparing pure acetaldehyde; in organic syntheses. *Caution:* Irritates eyes, mucous membranes.

**29. Acetaldehyde Sodium Bisulfite.** *1-Hydroxyethanesulfonic acid sodium salt.* $C_2H_5NaO_4S$; mol wt 157.13. C 15.29%, H 3.85%, Na 14.64%, O 45.82%, S 20.41%. $CH_3CH(OH)SO_3Na$.

Hemihydrate, crystals. Decomposed by acids. Freely sol in water; insol in alcohol.

USE: Making pure acetaldehyde; in organic synthesis. *Caution:* Irritates skin, mucous membranes.

**30. Acetaldoxime.** *Acetaldehyde oxime;* aldoxime; ethylidenehydroxylamine. $C_2H_5NO$; mol wt 59.07. C 40.66%, H 8.53%, N 23.72%, O 27.09%. $CH_3CH{=}NOH$. Prepn: Dunstan, Dymond, *J. Chem. Soc.* **61**, 470 (1892). Manuf: Donaruma, U.S. pat. **2,763,686** (1956 to du Pont).

Two crystalline modifications, mp 12° (β-form), mp 46.5° (α-form). d 0.966. bp 114.5°. $n_D^{20}$ 1.415. Dec by aq HCl into acetaldehyde and hydroxylamine. Very sol in water, alcohol, ether.

**31. Acetamide.** Acetic acid amide. $C_2H_5NO$; mol wt 59.07. C 40.66%, H 8.53%, N 23.72%, O 27.09%. $CH_3CONH_2$. Prepd by fractional distillation of ammonium acetate: Coleman, Alvarado, *Org. Syn.* **3**, 3 (1923); **coll. vol. I** (2nd ed., 1941) p 3; Gattermann-Wieland, *Praxis des organischen Chemikers* (40th ed., 1961) p 118; Vogel, *Practical Organic Chemistry* (3rd ed., 1959) p 401. From ethyl acetate: Vogel, *op. cit.*, p 403. Studies of acetamide as an ionizing solvent: Jauder, Winkler, *J. Inorg. Nucl. Chem.* **9**, 24, 32, 39 (1959).

Deliquescent hexagonal crystals. Odorless when pure, but frequently has a mousy odor. $d_4^{20}$ 1.159. mp 81°. $bp_{760}$ 222°; $bp_{100}$ 158°; $bp_{40}$ 136°; $bp_{20}$ 120°; $bp_{10}$ 105°; $bp_5$ 92°. $n_D^{78}$ 1.4274. Neutral reaction. Kb at 25° = $3.1 \times 10^{-15}$. One gram dissolves in 0.5 ml water, 2 ml alcohol, 6 ml pyridine. Sol in chloroform, glycerol, hot benzene. Toxicological study: Weisburger *et al.*, *Toxicol. Appl. Pharmacol.* **14**, 163 (1969).

USE: Solvent; molten acetamide is an excellent solvent for many organic and inorganic compounds. Solubilizer; renders sparingly soluble substances more soluble in water by mere addition or by fusion. Plasticizer; stabilizer. Manuf methylamine, denaturing alcohol. In organic syntheses. *Caution:* Mild irritant.

**32. Acetamidine Hydrochloride.** *Ethanimidamide hydrochloride;* ethanamidine hydrochloride; α-amino-α-iminoethane hydrochloride; ethenylamidine hydrochloride; acediamine hydrochloride; SN 4.455. $C_2H_7ClN_2$; mol wt 94.55. C 25.41%, H 7.46%, Cl 37.50%, N 29.63%. Prepd by passing HCl into a soln of acetonitrile in abs alcohol, then passing $NH_3$ into the reaction mixture: Pinner, *Ber.* **16**, 1654 (1883); **17**, 178 (1884); Dox, *Org. Syn.*, **coll. vol. I**, 5 (New York, 2nd ed., 1941). *See also* Fargher, *J. Chem. Soc.* **117**, 674 (1920). *Review:* Shriner, Neumann, *Chem. Rev.* **35**, 351-425 (1944).

$$CH_3\overset{\overset{NH}{\|}}{C}NH_2 \cdot HCl$$

Long prisms from alcohol, somewhat deliquescent, mp 174° (Fargher); mp 164-166° (Dox). Very sol in water. Sol in alcohols. Practically insol in acetone, ether. Should be stored in a closed container and in a cool place. If alkali is added to an aq soln, the free base is liberated.

Free base, $C_2H_6N_2$. uv max: 224 nm (ε 4000). $pK_1$ (25°): 12.1. Has a strong alkaline reaction and on slight warming dissociates into ammonia and acetic acid.

USE: In the synthesis of imidazoles, pyrimidines, triazines. *Caution:* Irritates mucous membranes, skin. Avoid tasting, swallowing, inhalation of the dust, skin contact.

**33. 2-Acetamido-6-aminobenzothiazole.** *N-(6-Amino-2-benzothiazolyl)acetamide;* 2-acetylamino-6-aminobenzothiazole. $C_9H_9N_3OS$; mol wt 207.24. C 52.16%, H 4.38%, N 20.28%, S 15.47%, O 7.72%. Synthesis: Kyosuke Tsuda *et al.*, *J. Pharm. Soc. Japan* **60**, 184 (1940); *Chem. Zentr.* **1941, II**, 335; *cf.* Kaufmann, *Arch. Pharm.* **273**, 46 (1935).

Crystals, mp 264°.

USE: Detection of iridium: Noell, Fish, *C.A.* **35**, 1000 (1941).

**34. ε-Acetamidocaproic Acid.** *6-Acetamidohexanoic acid;* acetaminocaproic acid; acexamic acid; *N*-acetyl-6-aminohexanoic acid. $C_8H_{15}NO_3$; mol wt 173.21. C 55.47%, H 8.73%, N 8.09%, O 27.71%. $CH_3CONH(CH_2)_5COOH$. Prepn: Offe, *Z. Naturforsch.* **2b**, 182 (1947); Fr. pat. **M2332** (1964 to Rowa), *C.A.* **61**, 577b (1964).

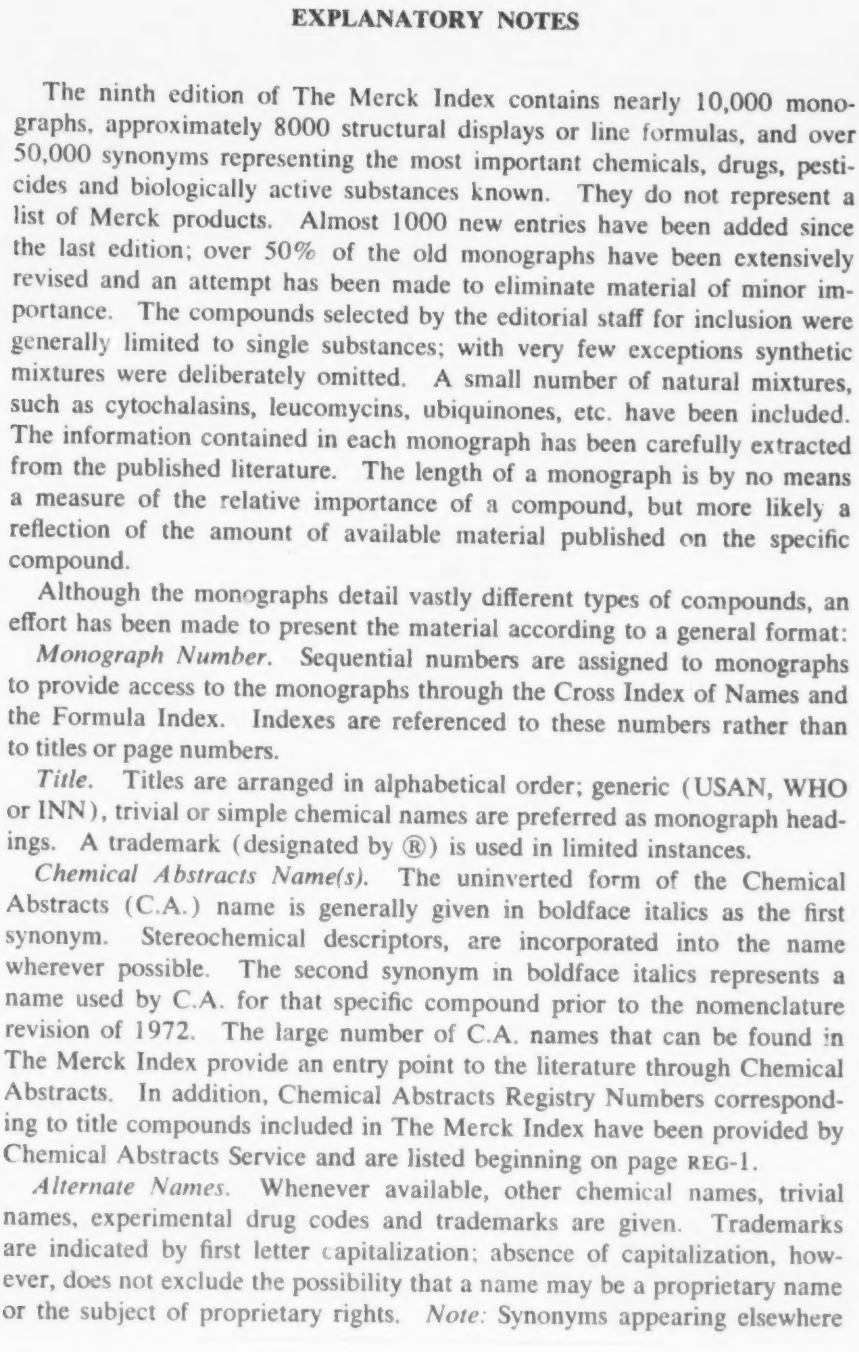
Crystals from acetone, mp 104-105.5° (Fr. pat. M2332), mp 112° (Offe, *loc. cit.*). $LD_{50}$ i.p. in mice: 7 g/kg.

Sodium salt, $C_8H_{14}NNaO_3$, ***Plastenan***.

THERAP CAT: Anti-inflammatory.

**35. 4-Acetamido-2-methyl-1-naphthol.** *4-Hydroxy-3-methyl-1-naphthaleneacetamide;* 4-acetylamino-2-methyl-1-naphthol; 1-hydroxy-2-methyl-4-acetylaminonaphthalene; *N*-acetyl vitamin $K_5$; K-Vitrat. $C_{13}H_{13}NO_2$; mol wt 215.24. C 72.54%, H 6.09%, N 6.51%, O 14.87%. Prepd from 4-amino-2-methyl-1-naphthol hydrochloride by treatment with acetic anhydride and anhydr sodium acetate in glacial acetic acid: Veldstra, Wiardi, *Rec. Trav. Chim.* **62**, 75 (1943).

Figure A-4. Typical entry from the Merck Index (7).



## EXPLANATORY NOTES

The ninth edition of The Merck Index contains nearly 10,000 monographs, approximately 8000 structural displays or line formulas, and over 50,000 synonyms representing the most important chemicals, drugs, pesticides and biologically active substances known. They do not represent a list of Merck products. Almost 1000 new entries have been added since the last edition; over 50% of the old monographs have been extensively revised and an attempt has been made to eliminate material of minor importance. The compounds selected by the editorial staff for inclusion were generally limited to single substances; with very few exceptions synthetic mixtures were deliberately omitted. A small number of natural mixtures, such as cytochalasins, leucomycins, ubiquinones, etc. have been included. The information contained in each monograph has been carefully extracted from the published literature. The length of a monograph is by no means a measure of the relative importance of a compound, but more likely a reflection of the amount of available material published on the specific compound.

Although the monographs detail vastly different types of compounds, an effort has been made to present the material according to a general format:

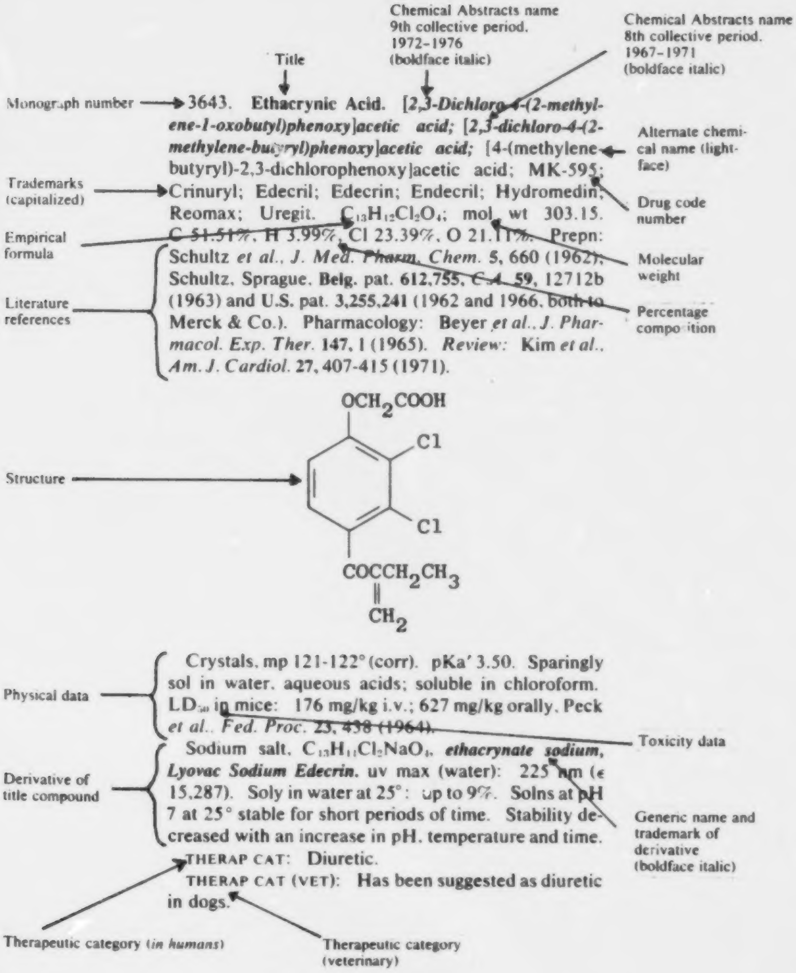
*Monograph Number.* Sequential numbers are assigned to monographs to provide access to the monographs through the Cross Index of Names and the Formula Index. Indexes are referenced to these numbers rather than to titles or page numbers.

*Title.* Titles are arranged in alphabetical order; generic (USAN, WHO or INN), trivial or simple chemical names are preferred as monograph headings. A trademark (designated by ®) is used in limited instances.

*Chemical Abstracts Name(s).* The uninverted form of the Chemical Abstracts (C.A.) name is generally given in boldface italics as the first synonym. Stereochemical descriptors, are incorporated into the name wherever possible. The second synonym in boldface italics represents a name used by C.A. for that specific compound prior to the nomenclature revision of 1972. The large number of C.A. names that can be found in The Merck Index provide an entry point to the literature through Chemical Abstracts. In addition, Chemical Abstracts Registry Numbers corresponding to title compounds included in The Merck Index have been provided by Chemical Abstracts Service and are listed beginning on page REG-1.

*Alternate Names.* Whenever available, other chemical names, trivial names, experimental drug codes and trademarks are given. Trademarks are indicated by first letter capitalization; absence of capitalization, however, does not exclude the possibility that a name may be a proprietary name or the subject of proprietary rights. *Note:* Synonyms appearing elsewhere

Figure A-5. Explanatory notes from Merck Index (7).



**3643. Ethacrynic Acid.** [***2,3-Dichloro-4-(2-methylene-1-oxobutyl)phenoxy***]***acetic acid;*** [***2,3-dichloro-4-(2-methylene-butyryl)phenoxy***]***acetic acid;*** [4-(methylenebutyryl)-2,3-dichlorophenoxy]acetic acid; MK-595; Crinuryl; Edecril; Edecrin; Endecril; Hydromedin; Reomax; Uregit. $C_{13}H_{12}Cl_2O_4$; mol wt 303.15. C 51.51%, H 3.99%, Cl 23.39%, O 21.11%. Prepn: Schultz *et al., J. Med. Pharm. Chem.* 5, 660 (1962); Schultz, Sprague, **Belg.** pat. **612,755**, *C.A.* **59**, 12712b (1963) and U.S. pat. **3,255,241** (1962 and 1966, both to Merck & Co.). Pharmacology: Beyer *et al., J. Pharmacol. Exp. Ther.* **147**, 1 (1965). *Review:* Kim *et al., Am. J. Cardiol.* **27**, 407-415 (1971).

Crystals, mp 121-122° (corr). pKa′ 3.50. Sparingly sol in water, aqueous acids; soluble in chloroform. $LD_{50}$ in mice: 176 mg/kg i.v.; 627 mg/kg orally, Peck *et al., Fed. Proc.* 23, 438 (1964).

Sodium salt, $C_{13}H_{11}Cl_2NaO_4$, ***ethacrynate sodium, Lyovac Sodium Edecrin.*** uv max (water): 225 nm (ε 15,287). Soly in water at 25°: up to 9%. Solns at pH 7 at 25° stable for short periods of time. Stability decreased with an increase in pH, temperature and time.

THERAP CAT: Diuretic.

THERAP CAT (VET): Has been suggested as diuretic in dogs.

Chemical Abstracts name 9th collective period. 1972–1976 (boldface italic)
Chemical Abstracts name 8th collective period. 1967–1971 (boldface italic)
Title
Monograph number
Alternate chemical name (lightface)
Trademarks (capitalized)
Drug code number
Empirical formula
Molecular weight
Literature references
Percentage composition
OCH2COOH
Cl
Structure
Cl
COCCH2CH3
CH2
Physical data
Toxicity data
Derivative of title compound
Generic name and trademark of derivative (boldface italic)
Therapeutic category (in humans)
Therapeutic category (veterinary)

in the monograph are in boldface italics and also appear in the Cross Index of Names.

*Empirical Formula, Molecular Weight, % Composition.* This information is provided for all compounds having a specific known structure. Empirical formulas are listed in the Formula Index which provides a key back to the monographs.

*Literature References.* This portion of the monograph represents a concise reference history of the compound. It often contains a capsule state-

Figure A-5. (continued).

ment followed by citations of isolation, preparation, structural studies, pharmacology, and patent information and reviews, where available. In the case of families of compounds, especially inorganics, review articles are generally cited only in the monograph for the parent element or compound. Literature references are reported in the conventional manner; journal abbreviations correspond (with the few exceptions listed in the table of Abbreviations, p. xii) to those in *Chemical Abstracts Service Source Index* (CASSI).

*Structure.* An attempt has been made to depict the structures with the most modern stereochemical representations. Spatial drawings are used where appropriate as well as the standard conventions of heavy and dotted lines to show spatial arrangements of bonds directed above or below the plane of the paper.

*Physical Data.* The data reported has been extracted from references cited within the monograph and is presented in its original form. Whenever possible, the color of the substance is stated, but the absence of color (white, colorless) is often omitted. Temperatures are given in degrees Celsius (centigrade) unless otherwise noted. When solubilities are determined at room temperature, about 25 °C, the temperature is generally omitted. When optical rotations are measured in water, the solvent is usually not specified. In the case of ultraviolet absorption measurements, the solvent is provided within parentheses. Solubility and stability data are given whenever available, using terminology found in the original papers.

A great effort has been made for this edition to provide toxicity data in the form of $LD_{50}$, $LC_{50}$ etc. and include the source of this toxicity information in the monograph. In addition, *Caution* or *Human Toxicity* statements are provided where applicable. Specific caution statements are given for drugs and compounds on the U.S. Government's Schedules of Controlled Substances, for additives controlled by the Food and Drug Administration and for compounds listed as carcinogens by the Occupational Safety and Health Administration. *Note:* Absence of toxicity data does not imply that toxic effects do not exist.

*Derivatives.* The presentation of chemical data for derivatives follows the same format as that used for the parent compound. The empirical formula corresponding to a derivative is listed in the Formula Index only if there is a specific C.A. name, generic name or trademark associated with it.

*Use.* Specific uses which are not of a medical or veterinary nature are described here.

*Therapeutic Category.* For this edition, the medical editors have followed as closely as possible the categories of activity proposed by the USAN Council to describe the major therapeutic indications of drugs.

*Therapeutic Category (Veterinary).* The veterinary staff has provided short, descriptive phrases detailing the major veterinary applications.

*Indexes.* Each listing in the Formula Index and Cross Index of Names directs the reader to the monograph number in which the compound is described. An attempt has been made to match trademarks with company ownership and to include that information in the Cross Index Names. An abbreviated form of the company name appears in brackets following a

Figure A-5. (continued).

large number of trademarks. The addresses of the companies for which there are multiple trademarks are compiled in a Company Register which starts on page MISC-37. This is an initial effort and will be expanded in future editions.

The Merck Index has a strong medical character, but it must be emphasized that it is not intended as a therapeutic guide. Inclusion of a drug in this book is not to be taken as an endorsement but merely as a statement of the fact that such a drug exists. The THERAPEUTIC CATEGORY and THERAPEUTIC CATEGORY (VETERINARY) paragraphs which appear under most drugs are intended only as summary statements of major pharmacological properties or indications for the individual drugs. For additional information on uses, dosage, side effects and adverse reactions, readers are referred to pertinent scientific and professional literature and to product circulars published by the respective manufacturers.

Great care has been taken to assure the accuracy of the information contained in The Merck Index. However, the Editorial Staff and the Publisher cannot be responsible for errors in publication or for any consequences arising from the use of the information published in The Merck Index. Accordingly, reference to original sources is encouraged as is reporting of errors and omissions in order to assure that appropriate changes may be made in the next edition.

Figure A-5. (continued).

## Explanatory Notes on Manual

I **Composition**

1. Names of Chemicals
2. Handling and Disposal Manual for Toxic and Hazardous Industrial Chemicals with Toxicity and Hazard Data
3. Index

II **Items inlcuded in Manual for Each Chemical**

1. Chemical Name and Synonyms
2. Constitutional Formula or Rational Formula
3. Uses
4. Properties
5. Criteria for Hazard
   a) flash point b) ignition point c) vapor pressure d) explosion limits
   e) vapor density f) others
6. Criteria for Toxicity
   a) TLV LD LC TD TC
   b) Acute and chronic symptons
7. Handling and Storage
   a) Storage precautions b) Safety devices and protectors
   c) Hazardous reaction data
8. Emergency Treatments and Measures
   1) Hygienic precautions
      a) Human Hygiene b) Work environmental administration
      c) Safety devices
   2) Hygienic Treatments (First Aid)
   3) Fire Precautions
   Extinguishing chemicals and fighting precautions
9. Spills and Leakage
10. Disposal and Waste Treatment

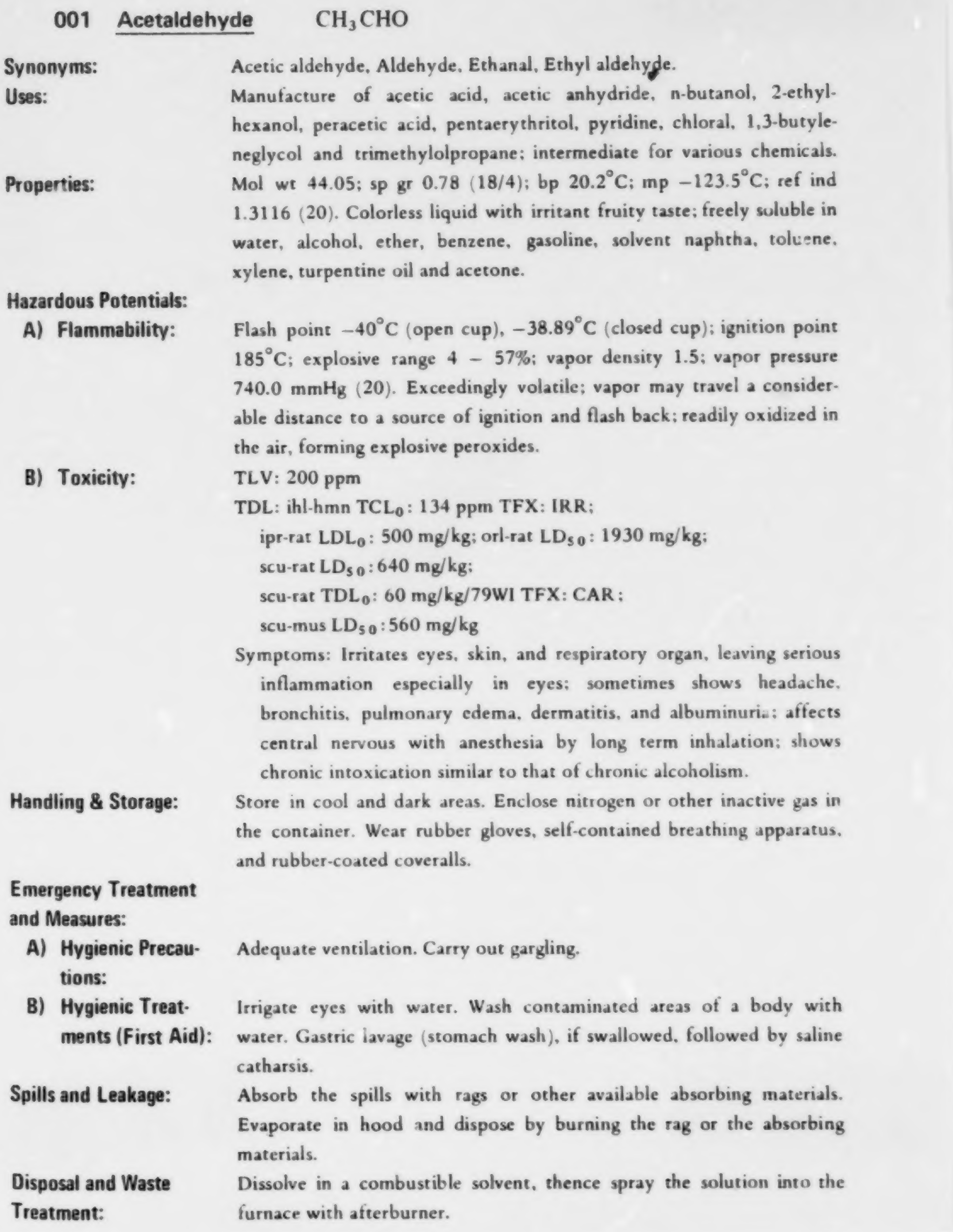
III **Index**

The alphabetical index contains both chemical names (printed in bold faces) and synonyms, and is so arranged that search is made not by the page number, but by the index number assigned to each chemical, assuring rapid and accurate searches.

IV **Key to Abbreviations**

ALR–allergenic effects
BCM–blood clotting mechanism effects
bdw–wild bird species
BLD–blood effects
BPR–blood pressure effects
brd–bird (domestic or lab)

Figure A-6. Explanatory notes from Toxic and Hazardous Industrial Chemicals Safety Manual (8).



### 001 Acetaldehyde $CH_3CHO$

**Synonyms:** Acetic aldehyde, Aldehyde, Ethanal, Ethyl aldehyde.

**Uses:** Manufacture of acetic acid, acetic anhydride, n-butanol, 2-ethylhexanol, peracetic acid, pentaerythritol, pyridine, chloral, 1,3-butyleneglycol and trimethylolpropane; intermediate for various chemicals.

**Properties:** Mol wt 44.05; sp gr 0.78 (18/4); bp 20.2°C; mp −123.5°C; ref ind 1.3116 (20). Colorless liquid with irritant fruity taste; freely soluble in water, alcohol, ether, benzene, gasoline, solvent naphtha, toluene, xylene, turpentine oil and acetone.

**Hazardous Potentials:**

**A) Flammability:** Flash point −40°C (open cup), −38.89°C (closed cup); ignition point 185°C; explosive range 4 – 57%; vapor density 1.5; vapor pressure 740.0 mmHg (20). Exceedingly volatile; vapor may travel a considerable distance to a source of ignition and flash back; readily oxidized in the air, forming explosive peroxides.

**B) Toxicity:** TLV: 200 ppm

TDL: ihl-hmn $TCL_0$: 134 ppm TFX: IRR;
ipr-rat $LDL_0$: 500 mg/kg; orl-rat $LD_{50}$: 1930 mg/kg;
scu-rat $LD_{50}$: 640 mg/kg;
scu-rat $TDL_0$: 60 mg/kg/79WI TFX: CAR;
scu-mus $LD_{50}$: 560 mg/kg

Symptoms: Irritates eyes, skin, and respiratory organ, leaving serious inflammation especially in eyes; sometimes shows headache, bronchitis, pulmonary edema, dermatitis, and albuminuria; affects central nervous with anesthesia by long term inhalation; shows chronic intoxication similar to that of chronic alcoholism.

**Handling & Storage:** Store in cool and dark areas. Enclose nitrogen or other inactive gas in the container. Wear rubber gloves, self-contained breathing apparatus, and rubber-coated coveralls.

**Emergency Treatment and Measures:**

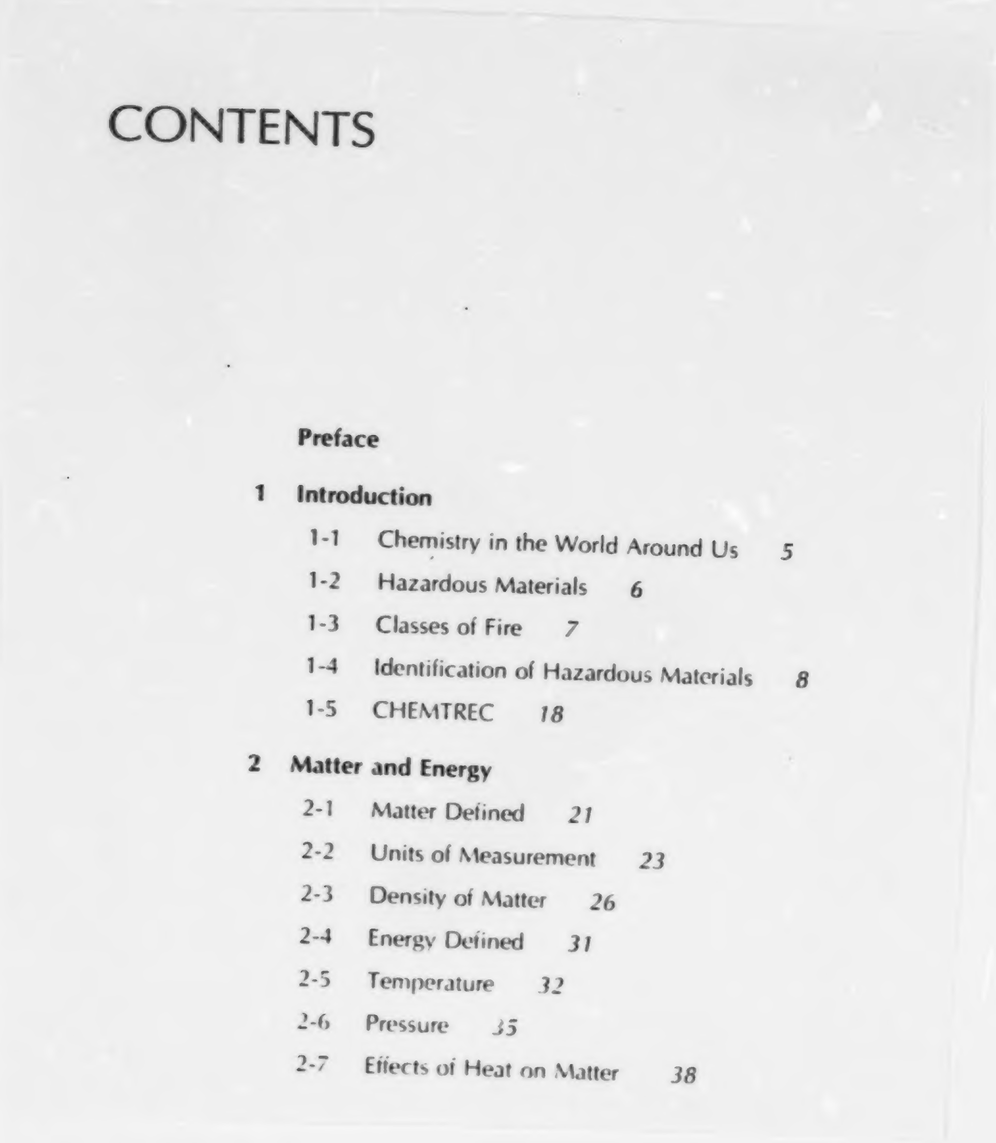
**A) Hygienic Precautions:** Adequate ventilation. Carry out gargling.

**B) Hygienic Treatments (First Aid):** Irrigate eyes with water. Wash contaminated areas of a body with water. Gastric lavage (stomach wash), if swallowed, followed by saline catharsis.

**Spills and Leakage:** Absorb the spills with rags or other available absorbing materials. Evaporate in hood and dispose by burning the rag or the absorbing materials.

**Disposal and Waste Treatment:** Dissolve in a combustible solvent, thence spray the solution into the furnace with afterburner.

Figure A-7. Typical entry from Toxic and Hazardous Industrial Chemicals Safety Manual (8).



# CONTENTS

**Preface**

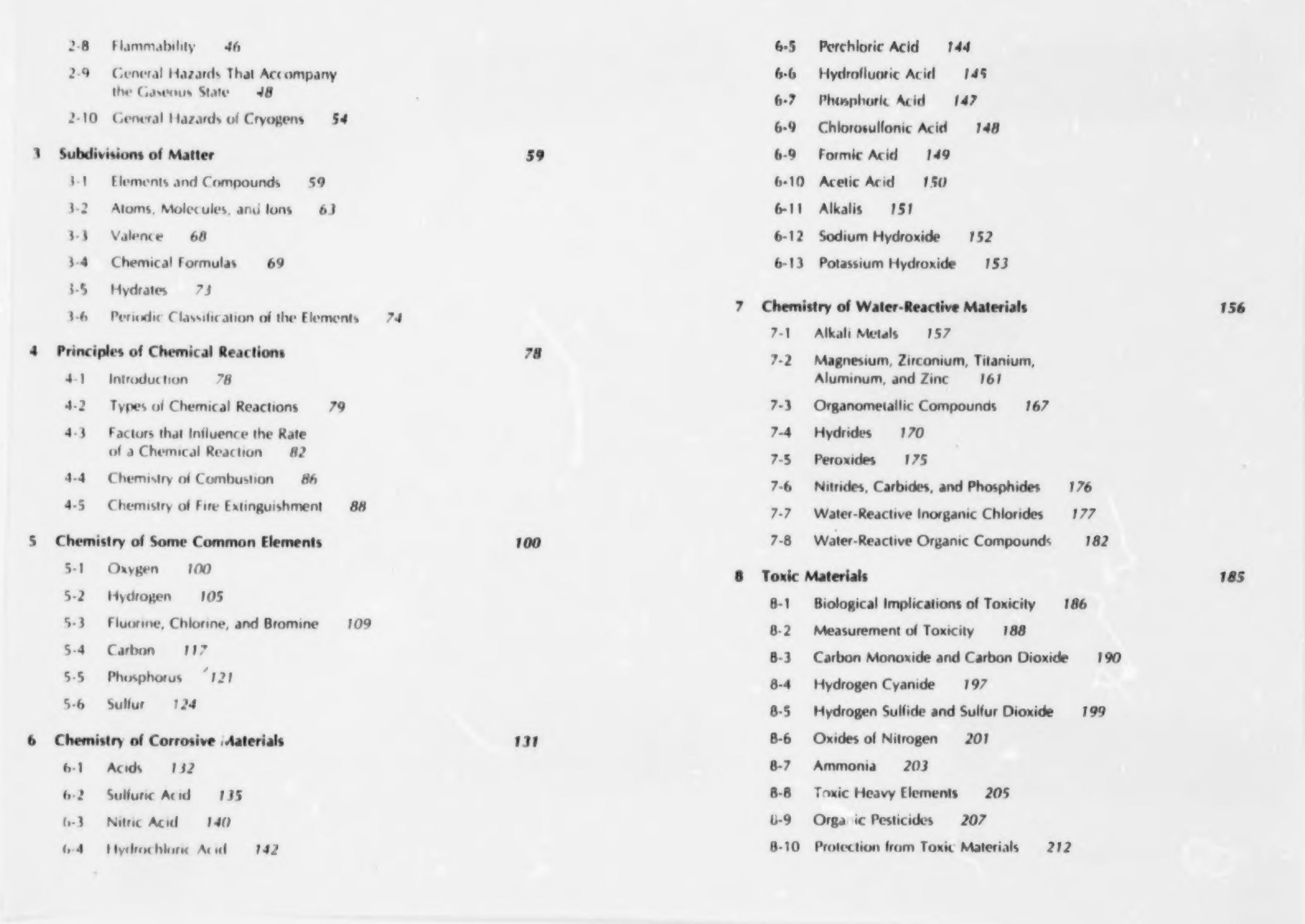
1 **Introduction**

- 1-1 Chemistry in the World Around Us *5*
- 1-2 Hazardous Materials *6*
- 1-3 Classes of Fire *7*
- 1-4 Identification of Hazardous Materials *8*
- 1-5 CHEMTREC *18*

2 **Matter and Energy**

- 2-1 Matter Defined *21*
- 2-2 Units of Measurement *23*
- 2-3 Density of Matter *26*
- 2-4 Energy Defined *31*
- 2-5 Temperature *32*
- 2-6 Pressure *35*
- 2-7 Effects of Heat on Matter *38*

Figure A-8. Table of contents from Chemistry of Hazardous Materials (10).



2-8 Flammability 46
2-9 General Hazards That Accompany the Gaseous State 48
2-10 General Hazards of Cryogens 54

**3 Subdivisions of Matter** **59**
3-1 Elements and Compounds 59
3-2 Atoms, Molecules, and Ions 63
3-3 Valence 68
3-4 Chemical Formulas 69
3-5 Hydrates 73
3-6 Periodic Classification of the Elements 74

**4 Principles of Chemical Reactions** **78**
4-1 Introduction 78
4-2 Types of Chemical Reactions 79
4-3 Factors that Influence the Rate of a Chemical Reaction 82
4-4 Chemistry of Combustion 86
4-5 Chemistry of Fire Extinguishment 88

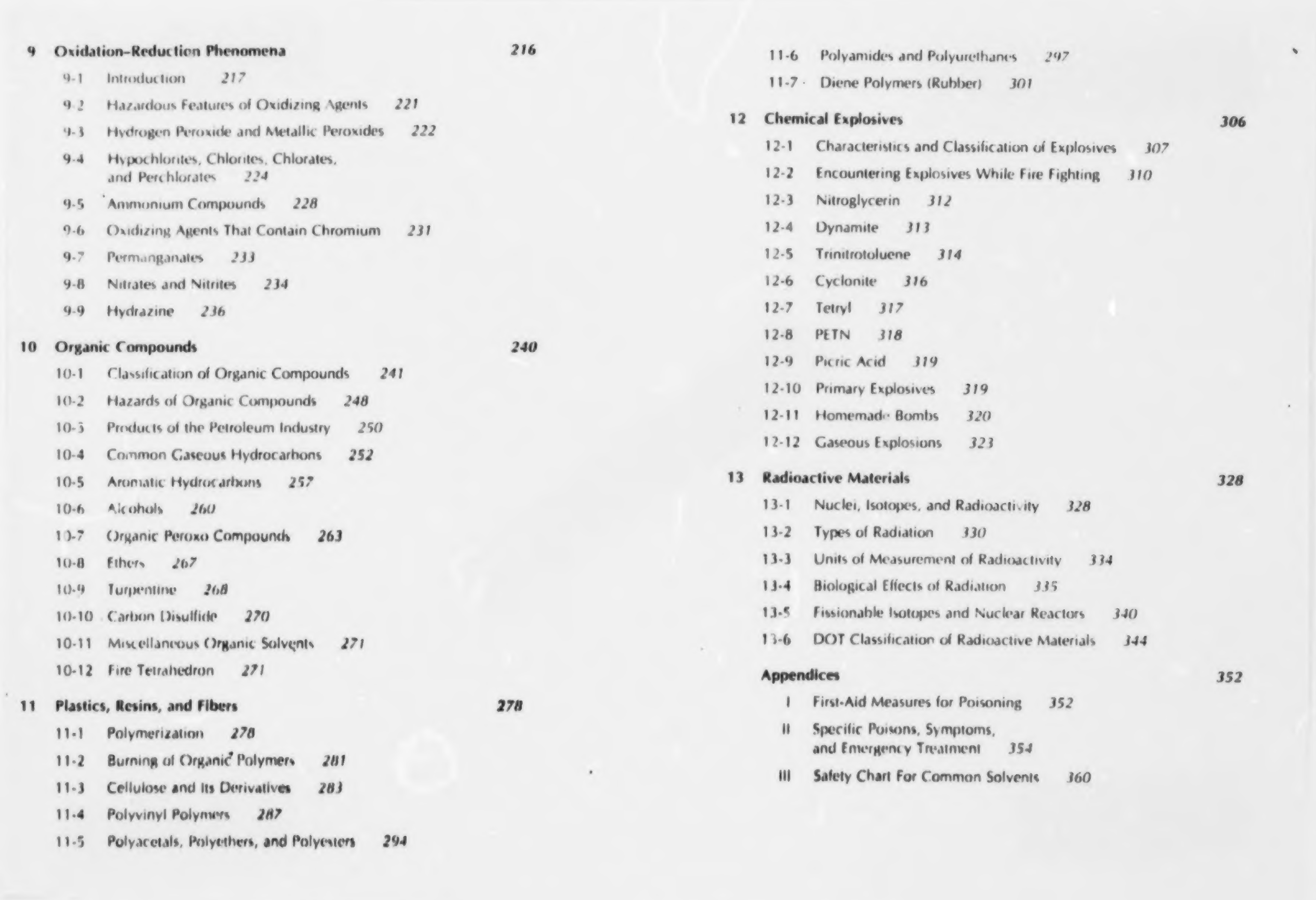
**5 Chemistry of Some Common Elements** **100**
5-1 Oxygen 100
5-2 Hydrogen 105
5-3 Fluorine, Chlorine, and Bromine 109
5-4 Carbon 117
5-5 Phosphorus 121
5-6 Sulfur 124

**6 Chemistry of Corrosive Materials** **131**
6-1 Acids 132
6-2 Sulfuric Acid 135
6-3 Nitric Acid 140
6-4 Hydrochloric Acid 142
6-5 Perchloric Acid 144
6-6 Hydrofluoric Acid 145
6-7 Phosphoric Acid 147
6-9 Chlorosulfonic Acid 148
6-9 Formic Acid 149
6-10 Acetic Acid 150
6-11 Alkalis 151
6-12 Sodium Hydroxide 152
6-13 Potassium Hydroxide 153

**7 Chemistry of Water-Reactive Materials** **156**
7-1 Alkali Metals 157
7-2 Magnesium, Zirconium, Titanium, Aluminum, and Zinc 161
7-3 Organometallic Compounds 167
7-4 Hydrides 170
7-5 Peroxides 175
7-6 Nitrides, Carbides, and Phosphides 176
7-7 Water-Reactive Inorganic Chlorides 177
7-8 Water-Reactive Organic Compounds 182

**8 Toxic Materials** **185**
8-1 Biological Implications of Toxicity 186
8-2 Measurement of Toxicity 188
8-3 Carbon Monoxide and Carbon Dioxide 190
8-4 Hydrogen Cyanide 197
8-5 Hydrogen Sulfide and Sulfur Dioxide 199
8-6 Oxides of Nitrogen 201
8-7 Ammonia 203
8-8 Toxic Heavy Elements 205
8-9 Organic Pesticides 207
8-10 Protection from Toxic Materials 212

Figure A-8. (continued).



9 **Oxidation–Reduction Phenomena** *216*
- 9-1 Introduction *217*
- 9-2 Hazardous Features of Oxidizing Agents *221*
- 9-3 Hydrogen Peroxide and Metallic Peroxides *222*
- 9-4 Hypochlorites, Chlorites, Chlorates, and Perchlorates *224*
- 9-5 Ammonium Compounds *228*
- 9-6 Oxidizing Agents That Contain Chromium *231*
- 9-7 Permanganates *233*
- 9-8 Nitrates and Nitrites *234*
- 9-9 Hydrazine *236*

10 **Organic Compounds** *240*
- 10-1 Classification of Organic Compounds *241*
- 10-2 Hazards of Organic Compounds *248*
- 10-3 Products of the Petroleum Industry *250*
- 10-4 Common Gaseous Hydrocarbons *252*
- 10-5 Aromatic Hydrocarbons *257*
- 10-6 Alcohols *260*
- 10-7 Organic Peroxo Compounds *263*
- 10-8 Ethers *267*
- 10-9 Turpentine *268*
- 10-10 Carbon Disulfide *270*
- 10-11 Miscellaneous Organic Solvents *271*
- 10-12 Fire Tetrahedron *271*

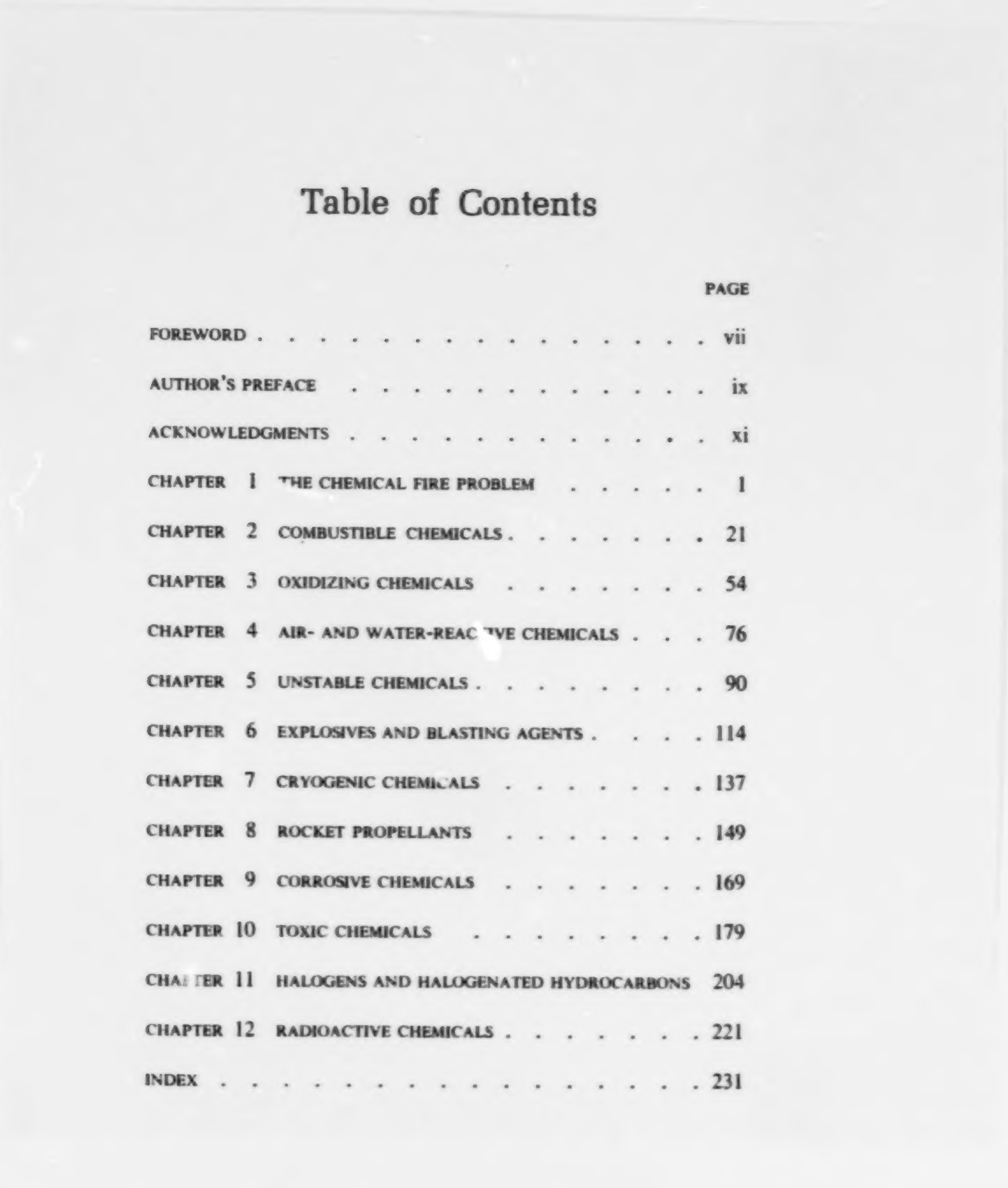
11 **Plastics, Resins, and Fibers** *278*
- 11-1 Polymerization *278*
- 11-2 Burning of Organic Polymers *281*
- 11-3 Cellulose and Its Derivatives *283*
- 11-4 Polyvinyl Polymers *287*
- 11-5 Polyacetals, Polyethers, and Polyesters *294*
- 11-6 Polyamides and Polyurethanes *297*
- 11-7 Diene Polymers (Rubber) *301*

12 **Chemical Explosives** *306*
- 12-1 Characteristics and Classification of Explosives *307*
- 12-2 Encountering Explosives While Fire Fighting *310*
- 12-3 Nitroglycerin *312*
- 12-4 Dynamite *313*
- 12-5 Trinitrotoluene *314*
- 12-6 Cyclonite *316*
- 12-7 Tetryl *317*
- 12-8 PETN *318*
- 12-9 Picric Acid *319*
- 12-10 Primary Explosives *319*
- 12-11 Homemade Bombs *320*
- 12-12 Gaseous Explosions *323*

13 **Radioactive Materials** *328*
- 13-1 Nuclei, Isotopes, and Radioactivity *328*
- 13-2 Types of Radiation *330*
- 13-3 Units of Measurement of Radioactivity *334*
- 13-4 Biological Effects of Radiation *335*
- 13-5 Fissionable Isotopes and Nuclear Reactors *340*
- 13-6 DOT Classification of Radioactive Materials *344*

**Appendices** *352*
- I First-Aid Measures for Poisoning *352*
- II Specific Poisons, Symptoms, and Emergency Treatment *354*
- III Safety Chart For Common Solvents *360*

Figure A-8. (continued).



## Table of Contents

PAGE

FOREWORD . . . . . . . . . . . . . . . . . vii

AUTHOR'S PREFACE . . . . . . . . . . . . . . ix

ACKNOWLEDGMENTS . . . . . . . . . . . . . . xi

CHAPTER 1 THE CHEMICAL FIRE PROBLEM . . . . . . 1

CHAPTER 2 COMBUSTIBLE CHEMICALS . . . . . . . . 21

CHAPTER 3 OXIDIZING CHEMICALS . . . . . . . . 54

CHAPTER 4 AIR- AND WATER-REACTIVE CHEMICALS . . . 76

CHAPTER 5 UNSTABLE CHEMICALS . . . . . . . . . 90

CHAPTER 6 EXPLOSIVES AND BLASTING AGENTS . . . . 114

CHAPTER 7 CRYOGENIC CHEMICALS . . . . . . . . 137

CHAPTER 8 ROCKET PROPELLANTS . . . . . . . . 149

CHAPTER 9 CORROSIVE CHEMICALS . . . . . . . . 169

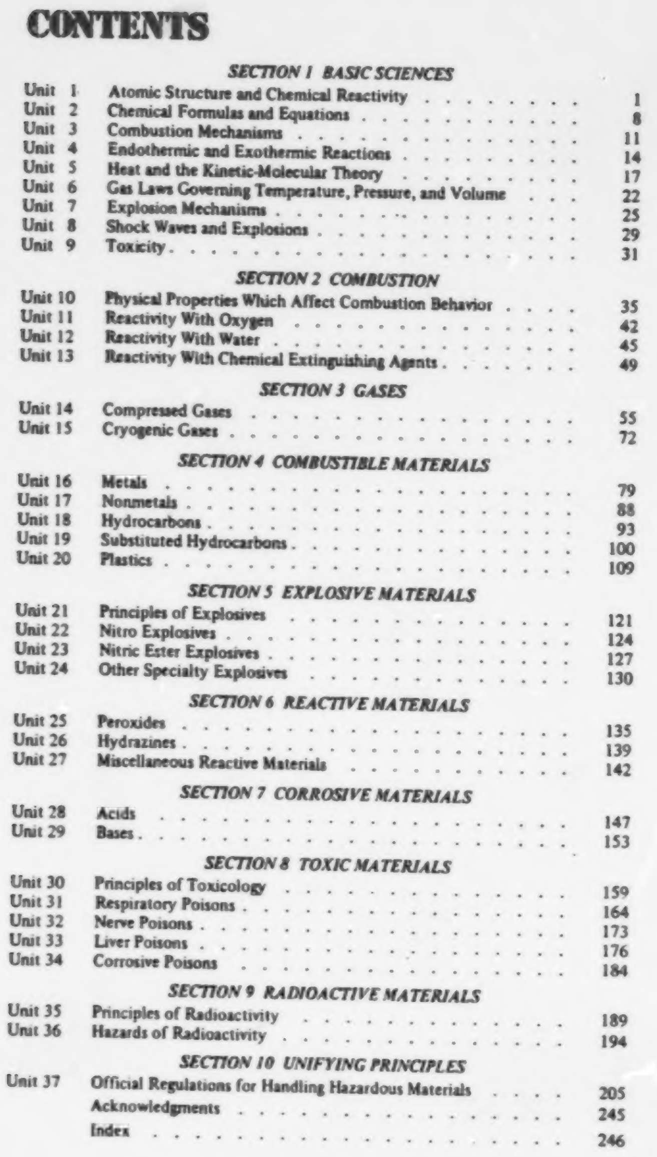
CHAPTER 10 TOXIC CHEMICALS . . . . . . . . . 179

CHAPTER 11 HALOGENS AND HALOGENATED HYDROCARBONS 204

CHAPTER 12 RADIOACTIVE CHEMICALS . . . . . . . . 221

INDEX . . . . . . . . . . . . . . . . . . 231

Figure A-9. Table of contents from the Fire Officers Guide to Dangerous Chemicals (11).



# CONTENTS

### SECTION 1 BASIC SCIENCES

Unit 1 Atomic Structure and Chemical Reactivity . . . . . . . . . 1
Unit 2 Chemical Formulas and Equations . . . . . . . . . . . . 8
Unit 3 Combustion Mechanisms . . . . . . . . . . . . . . . 11
Unit 4 Endothermic and Exothermic Reactions . . . . . . . . . 14
Unit 5 Heat and the Kinetic-Molecular Theory . . . . . . . . . 17
Unit 6 Gas Laws Governing Temperature, Pressure, and Volume . . . 22
Unit 7 Explosion Mechanisms . . . . . . . . . . . . . . . 25
Unit 8 Shock Waves and Explosions . . . . . . . . . . . . 29
Unit 9 Toxicity . . . . . . . . . . . . . . . . . . . 31

### SECTION 2 COMBUSTION

Unit 10 Physical Properties Which Affect Combustion Behavior . . . . 35
Unit 11 Reactivity With Oxygen . . . . . . . . . . . . . . 42
Unit 12 Reactivity With Water . . . . . . . . . . . . . . . 45
Unit 13 Reactivity With Chemical Extinguishing Agents . . . . . . . 49

### SECTION 3 GASES

Unit 14 Compressed Gases . . . . . . . . . . . . . . . . 55
Unit 15 Cryogenic Gases . . . . . . . . . . . . . . . . 72

### SECTION 4 COMBUSTIBLE MATERIALS

Unit 16 Metals . . . . . . . . . . . . . . . . . . . 79
Unit 17 Nonmetals . . . . . . . . . . . . . . . . . . 88
Unit 18 Hydrocarbons . . . . . . . . . . . . . . . . . 93
Unit 19 Substituted Hydrocarbons . . . . . . . . . . . . . 100
Unit 20 Plastics . . . . . . . . . . . . . . . . . . . 109

### SECTION 5 EXPLOSIVE MATERIALS

Unit 21 Principles of Explosives . . . . . . . . . . . . . . 121
Unit 22 Nitro Explosives . . . . . . . . . . . . . . . . 124
Unit 23 Nitric Ester Explosives . . . . . . . . . . . . . . 127
Unit 24 Other Specialty Explosives . . . . . . . . . . . . . 130

### SECTION 6 REACTIVE MATERIALS

Unit 25 Peroxides . . . . . . . . . . . . . . . . . . 135
Unit 26 Hydrazines . . . . . . . . . . . . . . . . . . 139
Unit 27 Miscellaneous Reactive Materials . . . . . . . . . . . 142

### SECTION 7 CORROSIVE MATERIALS

Unit 28 Acids . . . . . . . . . . . . . . . . . . . 147
Unit 29 Bases . . . . . . . . . . . . . . . . . . . 153

### SECTION 8 TOXIC MATERIALS

Unit 30 Principles of Toxicology . . . . . . . . . . . . . . 159
Unit 31 Respiratory Poisons . . . . . . . . . . . . . . . 164
Unit 32 Nerve Poisons . . . . . . . . . . . . . . . . . 173
Unit 33 Liver Poisons . . . . . . . . . . . . . . . . . 176
Unit 34 Corrosive Poisons . . . . . . . . . . . . . . . . 184

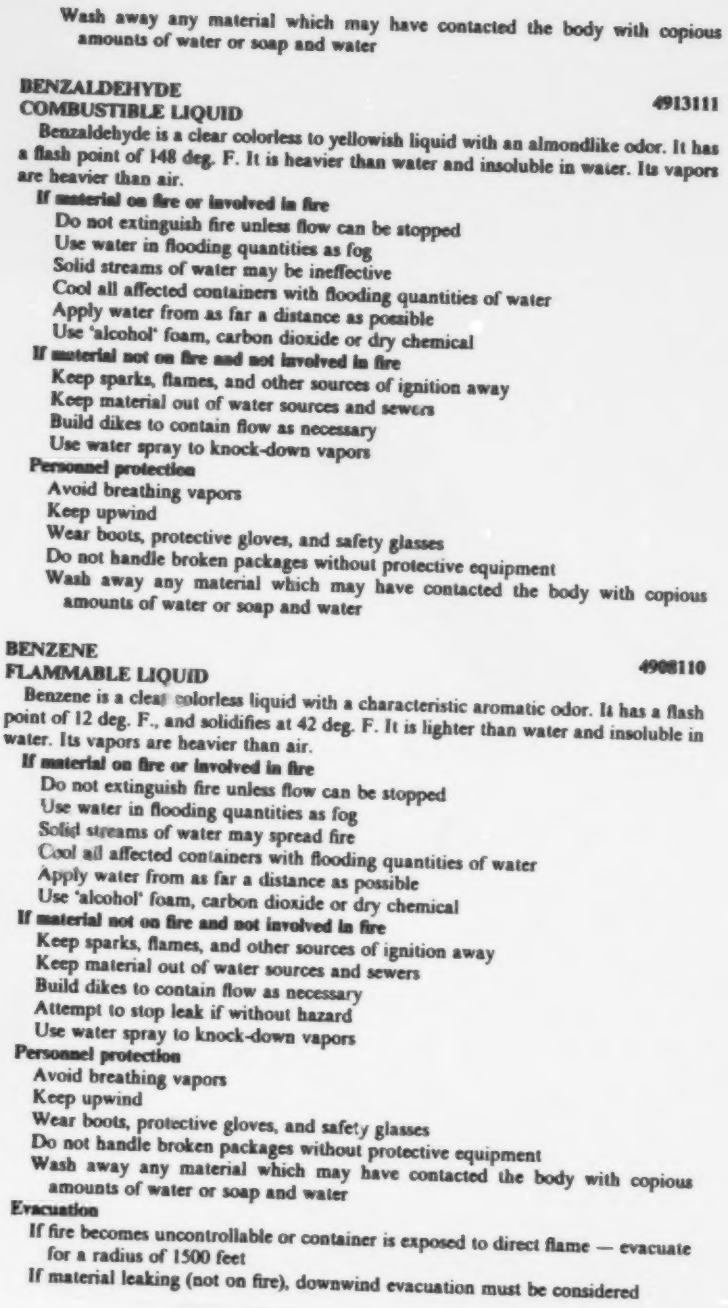
### SECTION 9 RADIOACTIVE MATERIALS

Unit 35 Principles of Radioactivity . . . . . . . . . . . . . 189
Unit 36 Hazards of Radioactivity . . . . . . . . . . . . . . 194

### SECTION 10 UNIFYING PRINCIPLES

Unit 37 Official Regulations for Handling Hazardous Materials . . . . 205
Acknowledgments . . . . . . . . . . . . . . . . 245
Index . . . . . . . . . . . . . . . . . . . 246

Figure A-10. Table of contents from Hazardous Materials (12).



Wash away any material which may have contacted the body with copious amounts of water or soap and water

**BENZALDEHYDE**
**COMBUSTIBLE LIQUID** **4913111**

Benzaldehyde is a clear colorless to yellowish liquid with an almondlike odor. It has a flash point of 148 deg. F. It is heavier than water and insoluble in water. Its vapors are heavier than air.

**If material on fire or involved in fire**
- Do not extinguish fire unless flow can be stopped
- Use water in flooding quantities as fog
- Solid streams of water may be ineffective
- Cool all affected containers with flooding quantities of water
- Apply water from as far a distance as possible
- Use 'alcohol' foam, carbon dioxide or dry chemical

**If material not on fire and not involved in fire**
- Keep sparks, flames, and other sources of ignition away
- Keep material out of water sources and sewers
- Build dikes to contain flow as necessary
- Use water spray to knock-down vapors

**Personnel protection**
- Avoid breathing vapors
- Keep upwind
- Wear boots, protective gloves, and safety glasses
- Do not handle broken packages without protective equipment
- Wash away any material which may have contacted the body with copious amounts of water or soap and water

**BENZENE**
**FLAMMABLE LIQUID** **4908110**

Benzene is a clear colorless liquid with a characteristic aromatic odor. It has a flash point of 12 deg. F., and solidifies at 42 deg. F. It is lighter than water and insoluble in water. Its vapors are heavier than air.

**If material on fire or involved in fire**
- Do not extinguish fire unless flow can be stopped
- Use water in flooding quantities as fog
- Solid streams of water may spread fire
- Cool all affected containers with flooding quantities of water
- Apply water from as far a distance as possible
- Use 'alcohol' foam, carbon dioxide or dry chemical

**If material not on fire and not involved in fire**
- Keep sparks, flames, and other sources of ignition away
- Keep material out of water sources and sewers
- Build dikes to contain flow as necessary
- Attempt to stop leak if without hazard
- Use water spray to knock-down vapors

**Personnel protection**
- Avoid breathing vapors
- Keep upwind
- Wear boots, protective gloves, and safety glasses
- Do not handle broken packages without protective equipment
- Wash away any material which may have contacted the body with copious amounts of water or soap and water

**Evacuation**
- If fire becomes uncontrollable or container is exposed to direct flame — evacuate for a radius of 1500 feet
- If material leaking (not on fire), downwind evacuation must be considered

Figure A-11. Typical entry from Emergency Handling of Hazardous Materials In Surface Transportation (13).

**BENZENE PHOSPHORUS DICHLORIDE** **4931715**
**CORROSIVE MATERIAL, ACIDIC**

Benzene phosphorus dichloride is a colorless fuming liquid. It is decomposed by water to give hydrochloric acid with release of heat. It is corrosive to metals and tissue.

**If material on fire or involved in fire**
- Use dry chemical or carbon dioxide
- Do not use water on material itself
- If large quantities of combustibles are involved, use water in flooding quantities as spray and fog
- Use water spray to absorb vapors
- Cool all affected containers with flooding quantities of water
- Apply water from as far a distance as possible

**If material not on fire and not involved in fire**
- Keep sparks, flames, and other sources of ignition away
- Keep material out of water sources and sewers
- Build dikes to contain flow as necessary
- Use water spray to knock-down vapors
- Do not use water on material itself
- Neutralize spilled material with crushed limestone, soda ash, or lime

**Personnel protection**
- Avoid breathing vapors
- Keep upwind
- Wear self-contained breathing apparatus
- Avoid bodily contact with the material
- Wear boots, protective gloves, and safety glasses
- Do not handle broken packages without protective equipment
- Wash away any material which may have contacted the body with copious amounts of water or soap and water
- If contact with the material anticipated, wear full protective clothing

**BENZENE PHOSPHORUS THIODICHLORIDE** **4931720**
**CORROSIVE MATERIAL, ACIDIC**

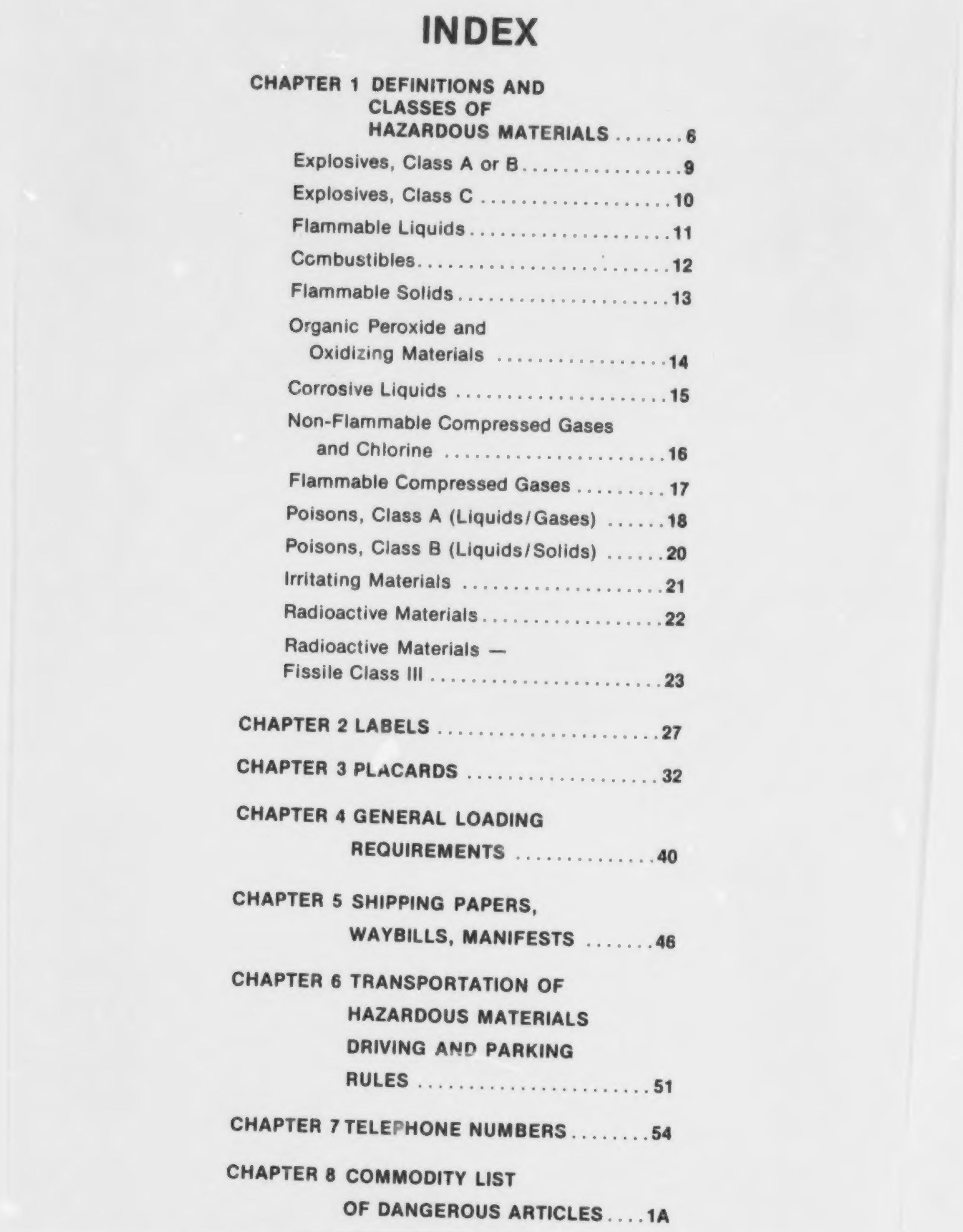
Benzene phosphorus thiodichloride is a colorless fuming liquid. It is decomposed by water to give hydrochloric acid with release of heat. It is corrosive to metals and tissue.

**If material on fire or involved in fire**
- Use dry chemical or carbon dioxide
- Do not use water on material itself
- If large quantities of combustibles are involved, use water in flooding quantities as spray and fog
- Use water spray to absorb vapors
- Cool all affected containers with flooding quantities of water
- Apply water from as far a distance as possible

**If material not on fire and not involved in fire**
- Keep sparks, flames, and other sources of ignition away
- Keep material out of water sources and sewers
- Build dikes to contain flow as necessary
- Use water spray to knock-down vapors
- Do not use water on material itself
- Neutralize spilled material with crushed limestone, soda ash, or lime

**Personnel protection**
- Avoid breathing vapors
- Keep upwind
- Wear self-contained breathing apparatus
- Avoid bodily contact with the material
- Wear boots, protective gloves, and safety glasses
- Do not handle broken packages without protective equipment
- Wash away any material which may have contacted the body with copious amounts of water or soap and water
- If contact with the material anticipated, wear full protective clothing

Figure A-11. (continued).



# INDEX

CHAPTER 1 DEFINITIONS AND CLASSES OF HAZARDOUS MATERIALS ....... 6
- Explosives, Class A or B ................ 9
- Explosives, Class C ................... 10
- Flammable Liquids ..................... 11
- Combustibles .......................... 12
- Flammable Solids ...................... 13
- Organic Peroxide and Oxidizing Materials ................. 14
- Corrosive Liquids ..................... 15
- Non-Flammable Compressed Gases and Chlorine ...................... 16
- Flammable Compressed Gases ......... 17
- Poisons, Class A (Liquids/Gases) ...... 18
- Poisons, Class B (Liquids/Solids) ...... 20
- Irritating Materials .................... 21
- Radioactive Materials .................. 22
- Radioactive Materials — Fissile Class III ...................... 23

CHAPTER 2 LABELS ...................... 27

CHAPTER 3 PLACARDS ................... 32

CHAPTER 4 GENERAL LOADING REQUIREMENTS ............. 40

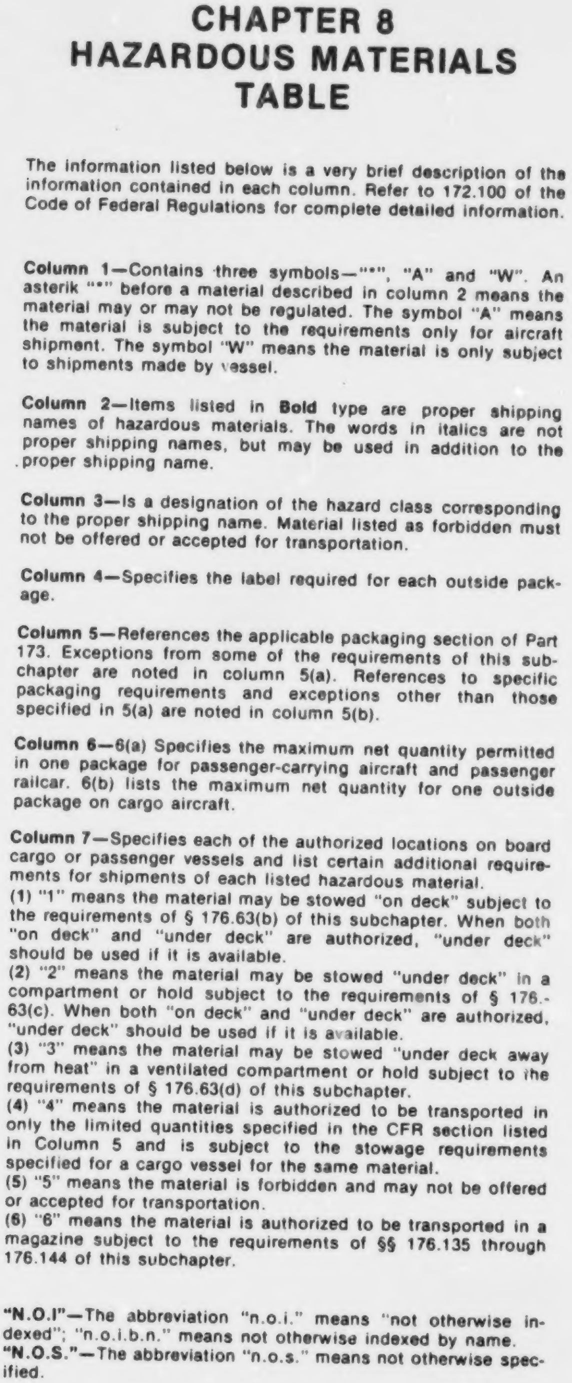
CHAPTER 5 SHIPPING PAPERS, WAYBILLS, MANIFESTS ....... 46

CHAPTER 6 TRANSPORTATION OF HAZARDOUS MATERIALS DRIVING AND PARKING RULES ...................... 51

CHAPTER 7 TELEPHONE NUMBERS ........ 54

CHAPTER 8 COMMODITY LIST OF DANGEROUS ARTICLES .... 1A

Figure A-12. Table of contents from Guide Lines to the Handling of Hazardous Materials (14).



# CHAPTER 8
# HAZARDOUS MATERIALS TABLE

The information listed below is a very brief description of the information contained in each column. Refer to 172.100 of the Code of Federal Regulations for complete detailed information.

**Column 1**—Contains three symbols—"*", "A" and "W". An asterik "*" before a material described in column 2 means the material may or may not be regulated. The symbol "A" means the material is subject to the requirements only for aircraft shipment. The symbol "W" means the material is only subject to shipments made by vessel.

**Column 2**—Items listed in **Bold** type are proper shipping names of hazardous materials. The words in italics are not proper shipping names, but may be used in addition to the proper shipping name.

**Column 3**—Is a designation of the hazard class corresponding to the proper shipping name. Material listed as forbidden must not be offered or accepted for transportation.

**Column 4**—Specifies the label required for each outside package.

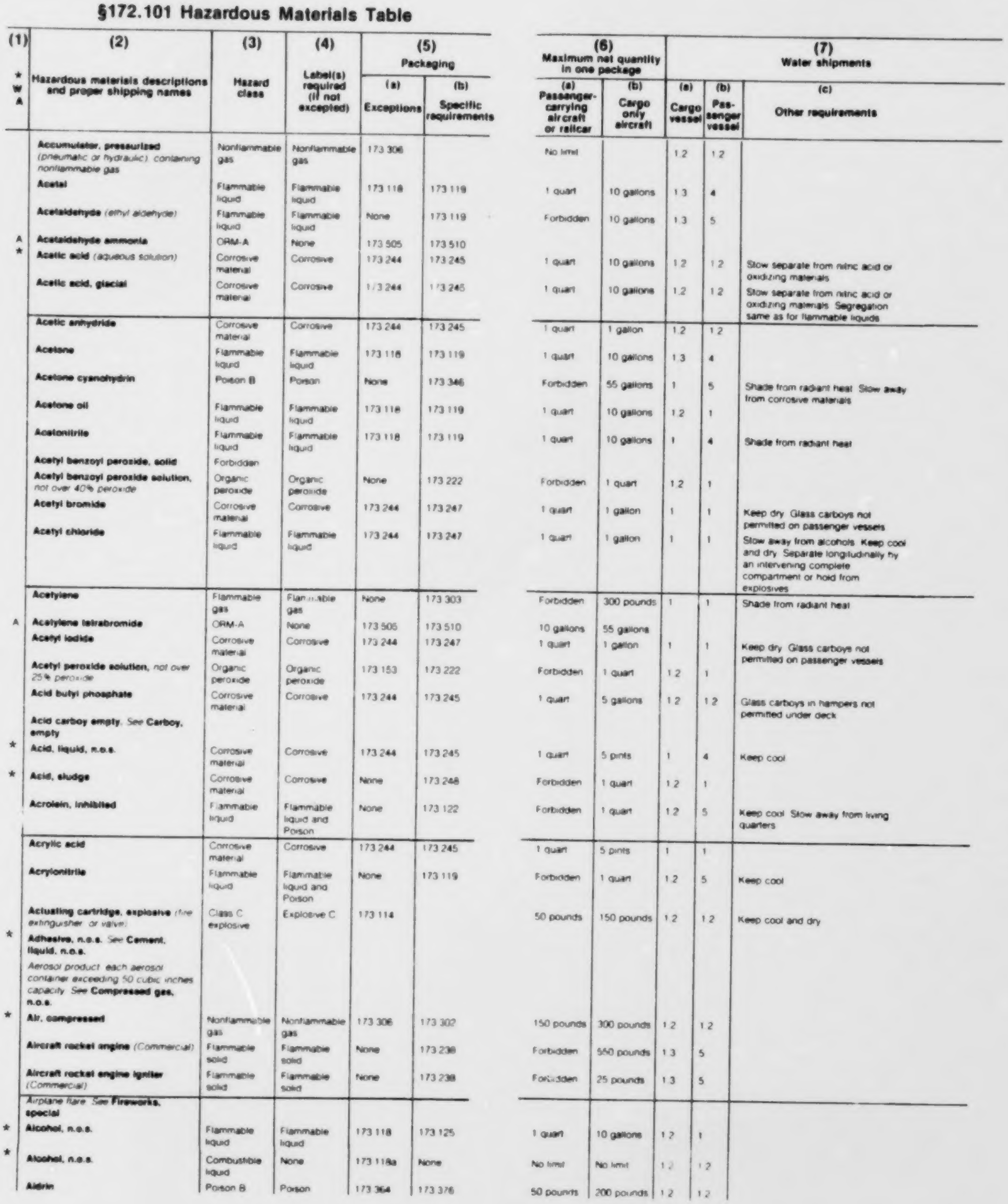
**Column 5**—References the applicable packaging section of Part 173. Exceptions from some of the requirements of this subchapter are noted in column 5(a). References to specific packaging requirements and exceptions other than those specified in 5(a) are noted in column 5(b).

**Column 6**—6(a) Specifies the maximum net quantity permitted in one package for passenger-carrying aircraft and passenger railcar. 6(b) lists the maximum net quantity for one outside package on cargo aircraft.

**Column 7**—Specifies each of the authorized locations on board cargo or passenger vessels and list certain additional requirements for shipments of each listed hazardous material.
(1) "1" means the material may be stowed "on deck" subject to the requirements of § 176.63(b) of this subchapter. When both "on deck" and "under deck" are authorized, "under deck" should be used if it is available.
(2) "2" means the material may be stowed "under deck" in a compartment or hold subject to the requirements of § 176.63(c). When both "on deck" and "under deck" are authorized, "under deck" should be used if it is available.
(3) "3" means the material may be stowed "under deck away from heat" in a ventilated compartment or hold subject to the requirements of § 176.63(d) of this subchapter.
(4) "4" means the material is authorized to be transported in only the limited quantities specified in the CFR section listed in Column 5 and is subject to the stowage requirements specified for a cargo vessel for the same material.
(5) "5" means the material is forbidden and may not be offered or accepted for transportation.
(6) "6" means the material is authorized to be transported in a magazine subject to the requirements of §§ 176.135 through 176.144 of this subchapter.

**"N.O.I"**—The abbreviation "n.o.i." means "not otherwise indexed"; "n.o.i.b.n." means not otherwise indexed by name.
**"N.O.S."**—The abbreviation "n.o.s." means not otherwise specified.

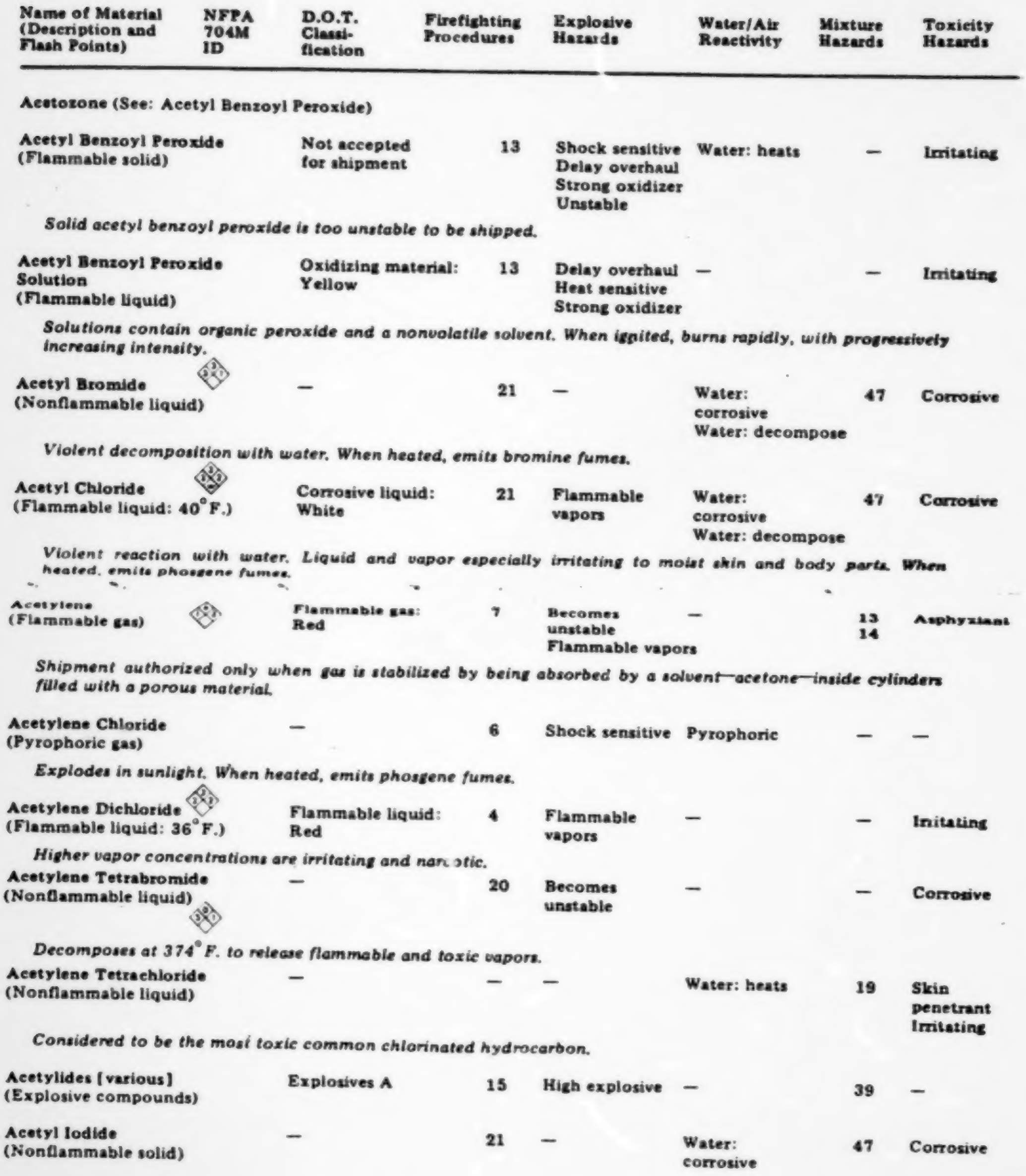
Figure A-13. General explanation from Guide Lines to the Handling of Hazardous Materials (14).



§172.101 Hazardous Materials Table

| (1) | (2) | (3) | (4) | (5) Packaging | | (6) Maximum net quantity in one package | | (7) Water shipments | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ★ W A | Hazardous materials descriptions and proper shipping names | Hazard class | Label(s) required (if not excepted) | (a) Exceptions | (b) Specific requirements | (a) Passenger-carrying aircraft or railcar | (b) Cargo only aircraft | (a) Cargo vessel | (b) Passenger vessel | (c) Other requirements |
| | **Accumulator, pressurized** *(pneumatic or hydraulic), containing nonflammable gas* | Nonflammable gas | Nonflammable gas | 173.306 | | No limit | | 1.2 | 1.2 | |
| | **Acetal** | Flammable liquid | Flammable liquid | 173.118 | 173.119 | 1 quart | 10 gallons | 1.3 | 4 | |
| | **Acetaldehyde** *(ethyl aldehyde)* | Flammable liquid | Flammable liquid | None | 173.119 | Forbidden | 10 gallons | 1.3 | 5 | |
| A | **Acetaldehyde ammonia** | ORM-A | None | 173.505 | 173.510 | | | | | |
| ★ | **Acetic acid** *(aqueous solution)* | Corrosive material | Corrosive | 173.244 | 173.245 | 1 quart | 10 gallons | 1.2 | 1.2 | Stow separate from nitric acid or oxidizing materials |
| | **Acetic acid, glacial** | Corrosive material | Corrosive | 173.244 | 173.245 | 1 quart | 10 gallons | 1.2 | 1.2 | Stow separate from nitric acid or oxidizing materials. Segregation same as for flammable liquids |
| | **Acetic anhydride** | Corrosive material | Corrosive | 173.244 | 173.245 | 1 quart | 1 gallon | 1.2 | 1.2 | |
| | **Acetone** | Flammable liquid | Flammable liquid | 173.118 | 173.119 | 1 quart | 10 gallons | 1.3 | 4 | |
| | **Acetone cyanohydrin** | Poison B | Poison | None | 173.346 | Forbidden | 55 gallons | 1 | 5 | Shade from radiant heat. Stow away from corrosive materials |
| | **Acetone oil** | Flammable liquid | Flammable liquid | 173.118 | 173.119 | 1 quart | 10 gallons | 1.2 | 1 | |
| | **Acetonitrile** | Flammable liquid | Flammable liquid | 173.118 | 173.119 | 1 quart | 10 gallons | 1 | 4 | Shade from radiant heat |
| | **Acetyl benzoyl peroxide, solid** | Forbidden | | | | | | | | |
| | **Acetyl benzoyl peroxide solution,** *not over 40% peroxide* | Organic peroxide | Organic peroxide | None | 173.222 | Forbidden | 1 quart | 1.2 | 1 | |
| | **Acetyl bromide** | Corrosive material | Corrosive | 173.244 | 173.247 | 1 quart | 1 gallon | 1 | 1 | Keep dry. Glass carboys not permitted on passenger vessels |
| | **Acetyl chloride** | Flammable liquid | Flammable liquid | 173.244 | 173.247 | 1 quart | 1 gallon | 1 | 1 | Stow away from alcohols. Keep cool and dry. Separate longitudinally by an intervening complete compartment or hold from explosives |
| | **Acetylene** | Flammable gas | Flammable gas | None | 173.303 | Forbidden | 300 pounds | 1 | 1 | Shade from radiant heat |
| A | **Acetylene tetrabromide** | ORM-A | None | 173.505 | 173.510 | 10 gallons | 55 gallons | | | |
| | **Acetyl iodide** | Corrosive material | Corrosive | 173.244 | 173.247 | 1 quart | 1 gallon | 1 | 1 | Keep dry. Glass carboys not permitted on passenger vessels |
| | **Acetyl peroxide solution,** *not over 25% peroxide* | Organic peroxide | Organic peroxide | 173.153 | 173.222 | Forbidden | 1 quart | 1.2 | 1 | |
| | **Acid butyl phosphate** | Corrosive material | Corrosive | 173.244 | 173.245 | 1 quart | 5 gallons | 1.2 | 1.2 | Glass carboys in hampers not permitted under deck |
| | **Acid carboy empty.** *See* **Carboy, empty** | | | | | | | | | |
| ★ | **Acid, liquid, n.o.s.** | Corrosive material | Corrosive | 173.244 | 173.245 | 1 quart | 5 pints | 1 | 4 | Keep cool |
| ★ | **Acid, sludge** | Corrosive material | Corrosive | None | 173.248 | Forbidden | 1 quart | 1.2 | 1 | |
| | **Acrolein, inhibited** | Flammable liquid | Flammable liquid and Poison | None | 173.122 | Forbidden | 1 quart | 1.2 | 5 | Keep cool. Stow away from living quarters |
| | **Acrylic acid** | Corrosive material | Corrosive | 173.244 | 173.245 | 1 quart | 5 pints | 1 | 1 | |
| | **Acrylonitrile** | Flammable liquid | Flammable liquid and Poison | None | 173.119 | Forbidden | 1 quart | 1.2 | 5 | Keep cool |
| | **Actuating cartridge, explosive** *(fire extinguisher or valve)* | Class C explosive | Explosive C | 173.114 | | 50 pounds | 150 pounds | 1.2 | 1.2 | Keep cool and dry |
| ★ | **Adhesive, n.o.s.** *See* **Cement, liquid, n.o.s.** | | | | | | | | | |
| | *Aerosol product: each aerosol container exceeding 50 cubic inches capacity. See* **Compressed gas, n.o.s.** | | | | | | | | | |
| ★ | **Air, compressed** | Nonflammable gas | Nonflammable gas | 173.306 | 173.302 | 150 pounds | 300 pounds | 1.2 | 1.2 | |
| | **Aircraft rocket engine** *(Commercial)* | Flammable solid | Flammable solid | None | 173.238 | Forbidden | 550 pounds | 1.3 | 5 | |
| | **Aircraft rocket engine igniter** *(Commercial)* | Flammable solid | Flammable solid | None | 173.238 | Forbidden | 25 pounds | 1.3 | 5 | |
| | *Airplane flare. See* **Fireworks, special** | | | | | | | | | |
| ★ | **Alcohol, n.o.s.** | Flammable liquid | Flammable liquid | 173.118 | 173.125 | 1 quart | 10 gallons | 1.2 | 1 | |
| ★ | **Alcohol, n.o.s.** | Combustible liquid | None | 173.118a | None | No limit | No limit | 1.2 | 1.2 | |
| | **Aldrin** | Poison B | Poison | 173.364 | 173.376 | 50 pounds | 200 pounds | 1.2 | 1.2 | |

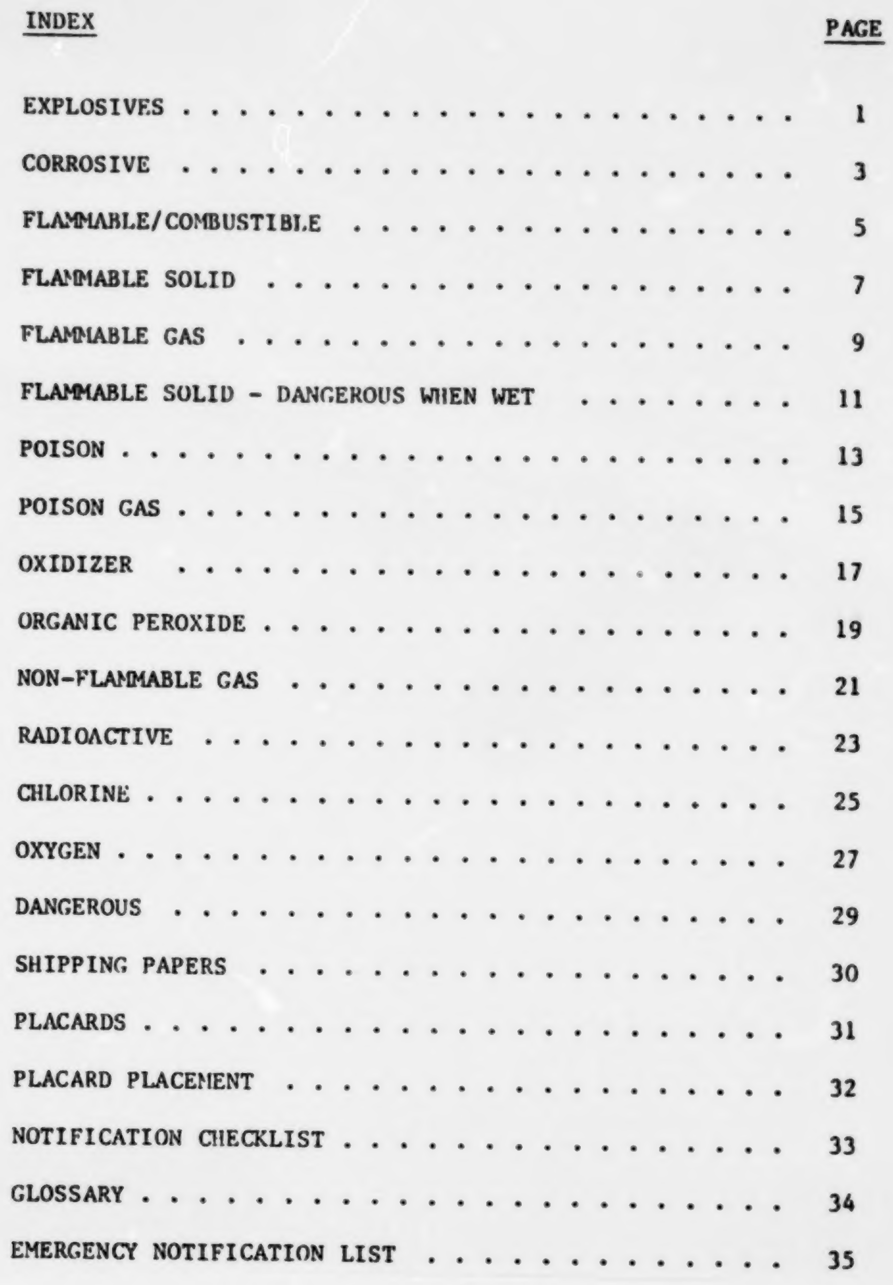
Figure A-14. Typical entries from Guide Lines to the Handling of Hazardous Materials (14).



| Name of Material (Description and Flash Points) | NFPA 704M ID | D.O.T. Classification | Firefighting Procedures | Explosive Hazards | Water/Air Reactivity | Mixture Hazards | Toxicity Hazards |
|---|---|---|---|---|---|---|---|
| **Acetozone (See: Acetyl Benzoyl Peroxide)** | | | | | | | |
| **Acetyl Benzoyl Peroxide** (Flammable solid) | | Not accepted for shipment | 13 | Shock sensitive<br>Delay overhaul<br>Strong oxidizer<br>Unstable | Water: heats | — | Irritating |
| *Solid acetyl benzoyl peroxide is too unstable to be shipped.* | | | | | | | |
| **Acetyl Benzoyl Peroxide Solution** (Flammable liquid) | | Oxidizing material: Yellow | 13 | Delay overhaul<br>Heat sensitive<br>Strong oxidizer | — | — | Irritating |
| *Solutions contain organic peroxide and a nonvolatile solvent. When ignited, burns rapidly, with progressively increasing intensity.* | | | | | | | |
| **Acetyl Bromide** (Nonflammable liquid) | ◇ | — | 21 | — | Water: corrosive<br>Water: decompose | 47 | Corrosive |
| *Violent decomposition with water. When heated, emits bromine fumes.* | | | | | | | |
| **Acetyl Chloride** (Flammable liquid: 40°F.) | ◇ | Corrosive liquid: White | 21 | Flammable vapors | Water: corrosive<br>Water: decompose | 47 | Corrosive |
| *Violent reaction with water. Liquid and vapor especially irritating to moist skin and body parts. When heated, emits phosgene fumes.* | | | | | | | |
| **Acetylene** (Flammable gas) | ◇ | Flammable gas: Red | 7 | Becomes unstable<br>Flammable vapors | — | 13<br>14 | Asphyxiant |
| *Shipment authorized only when gas is stabilized by being absorbed by a solvent—acetone—inside cylinders filled with a porous material.* | | | | | | | |
| **Acetylene Chloride** (Pyrophoric gas) | | — | 6 | Shock sensitive | Pyrophoric | — | — |
| *Explodes in sunlight. When heated, emits phosgene fumes.* | | | | | | | |
| **Acetylene Dichloride** (Flammable liquid: 36°F.) | ◇ | Flammable liquid: Red | 4 | Flammable vapors | — | — | Irritating |
| *Higher vapor concentrations are irritating and narcotic.* | | | | | | | |
| **Acetylene Tetrabromide** (Nonflammable liquid) | ◇ | — | 20 | Becomes unstable | — | — | Corrosive |
| *Decomposes at 374°F. to release flammable and toxic vapors.* | | | | | | | |
| **Acetylene Tetrachloride** (Nonflammable liquid) | | — | — | — | Water: heats | 19 | Skin penetrant<br>Irritating |
| *Considered to be the most toxic common chlorinated hydrocarbon.* | | | | | | | |
| **Acetylides [various]** (Explosive compounds) | | Explosives A | 15 | High explosive | — | 39 | — |
| **Acetyl Iodide** (Nonflammable solid) | | — | 21 | — | Water: corrosive | 47 | Corrosive |

Figure A-15. Typical listing from the Hazardous Materials Handbook (15).

206



INDEX PAGE

EXPLOSIVES . . . . . . . . . . . . . . . . . . . . . . . . . 1

CORROSIVE . . . . . . . . . . . . . . . . . . . . . . . . . 3

FLAMMABLE/COMBUSTIBLE . . . . . . . . . . . . . . . . . . 5

FLAMMABLE SOLID . . . . . . . . . . . . . . . . . . . . . . 7

FLAMMABLE GAS . . . . . . . . . . . . . . . . . . . . . . . 9

FLAMMABLE SOLID - DANGEROUS WHEN WET . . . . . . . . . 11

POISON . . . . . . . . . . . . . . . . . . . . . . . . . . 13

POISON GAS . . . . . . . . . . . . . . . . . . . . . . . . 15

OXIDIZER . . . . . . . . . . . . . . . . . . . . . . . . . 17

ORGANIC PEROXIDE . . . . . . . . . . . . . . . . . . . . . 19

NON-FLAMMABLE GAS . . . . . . . . . . . . . . . . . . . . 21

RADIOACTIVE . . . . . . . . . . . . . . . . . . . . . . . . 23

CHLORINE . . . . . . . . . . . . . . . . . . . . . . . . . 25

OXYGEN . . . . . . . . . . . . . . . . . . . . . . . . . . 27

DANGEROUS . . . . . . . . . . . . . . . . . . . . . . . . . 29

SHIPPING PAPERS . . . . . . . . . . . . . . . . . . . . . 30

PLACARDS . . . . . . . . . . . . . . . . . . . . . . . . . 31

PLACARD PLACEMENT . . . . . . . . . . . . . . . . . . . . 32

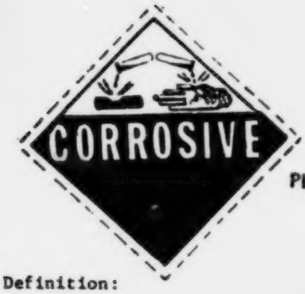
NOTIFICATION CHECKLIST . . . . . . . . . . . . . . . . . 33

GLOSSARY . . . . . . . . . . . . . . . . . . . . . . . . . 34

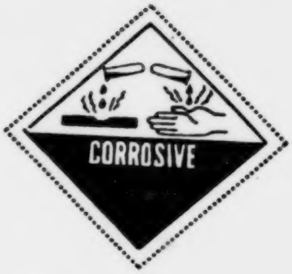
EMERGENCY NOTIFICATION LIST . . . . . . . . . . . . . . 35

Figure A-16. Table of contents from the Hazardous Materials Safety Manual(16).

# CORROSIVE



PLACARD



LABEL

Definition:

A liquid or solid that causes visible destruction or irreversible damage to skin tissue at the point of contact, or that has a corrosion rate on steel.

Examples: Phosphorus pentachloride, solid; Potassium fluoride solution; Sulfuric acid.

POTENTIAL HAZARDS

Fire - May catch fire.

Health - Vapors extremely irritating.

Contact may cause burns to skin and eyes. If inhaled, may be harmful.

Runoff may pollute water supply.

IMMEDIATE ACTION

Identify material involved.

Keep unnecessary people away.

Keep upwind, isolate hazard area.

Wear full protective gear.

IMMEDIATE FOLLOW-UP ACTION

Fire - Move containers from fire area if without risk.

Small fire - Dry chemical or $CO_2$.

Figure A-17. Typical entry from the Hazardous Materials Safety Manual (16).

IMMEDIATE FOLLOW UP ACTION (continued)

Large fire - Foam or water.

Cool containers with water from maximum distance until well after the fire is out.

SPILL or LEAK

Stop leak if without risk.

Do not touch spilled material.

Small Spill - Flush area with water.

Large Spill - Dilute with large amounts of water and dike for later disposal.

FIRST-AID

Remove contaminated clothing and shoes.

In case of contact with material immediately flush skin or eyes with running water for at least 15 minutes.

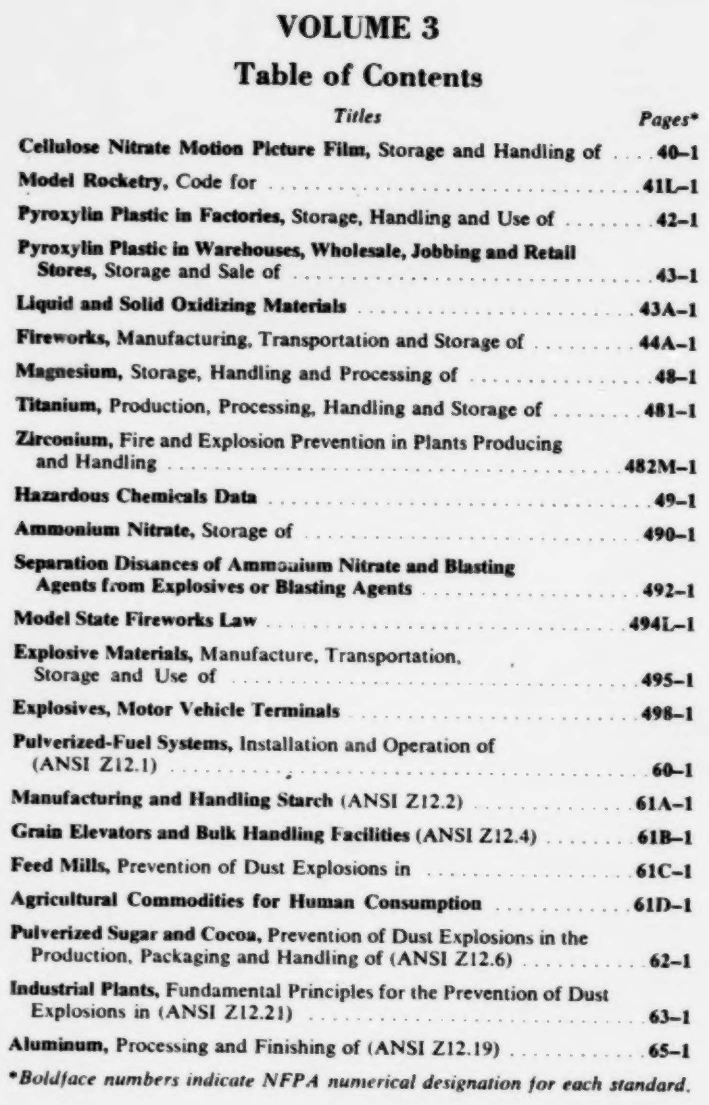
Keep patient warm and quiet.

Effects of contact or inhalation may be delayed.

Call physician.

*For detailed assistance in handling the hazard, call CHEMTREC (Chemical Transportation Emergency Center) toll free (800) 424-9300. Refer to page 35 for agencies available for information and/or assistance.

Figure A-17. (continued).



# VOLUME 3

## Table of Contents

| *Titles* | *Pages** |
|---|---|
| **Cellulose Nitrate Motion Picture Film,** Storage and Handling of | **40–1** |
| **Model Rocketry,** Code for | **41L–1** |
| **Pyroxylin Plastic in Factories,** Storage, Handling and Use of | **42–1** |
| **Pyroxylin Plastic in Warehouses, Wholesale, Jobbing and Retail Stores,** Storage and Sale of | **43–1** |
| **Liquid and Solid Oxidizing Materials** | **43A–1** |
| **Fireworks,** Manufacturing, Transportation and Storage of | **44A–1** |
| **Magnesium,** Storage, Handling and Processing of | **48–1** |
| **Titanium,** Production, Processing, Handling and Storage of | **481–1** |
| **Zirconium,** Fire and Explosion Prevention in Plants Producing and Handling | **482M–1** |
| **Hazardous Chemicals Data** | **49–1** |
| **Ammonium Nitrate,** Storage of | **490–1** |
| **Separation Distances of Ammonium Nitrate and Blasting Agents from Explosives or Blasting Agents** | **492–1** |
| **Model State Fireworks Law** | **494L–1** |
| **Explosive Materials,** Manufacture, Transportation, Storage and Use of | **495–1** |
| **Explosives, Motor Vehicle Terminals** | **498–1** |
| **Pulverized-Fuel Systems,** Installation and Operation of (ANSI Z12.1) | **60–1** |
| **Manufacturing and Handling Starch** (ANSI Z12.2) | **61A–1** |
| **Grain Elevators and Bulk Handling Facilities** (ANSI Z12.4) | **61B–1** |
| **Feed Mills,** Prevention of Dust Explosions in | **61C–1** |
| **Agricultural Commodities for Human Consumption** | **61D–1** |
| **Pulverized Sugar and Cocoa,** Prevention of Dust Explosions in the Production, Packaging and Handling of (ANSI Z12.6) | **62–1** |
| **Industrial Plants,** Fundamental Principles for the Prevention of Dust Explosions in (ANSI Z12.21) | **63–1** |
| **Aluminum,** Processing and Finishing of (ANSI Z12.19) | **65–1** |

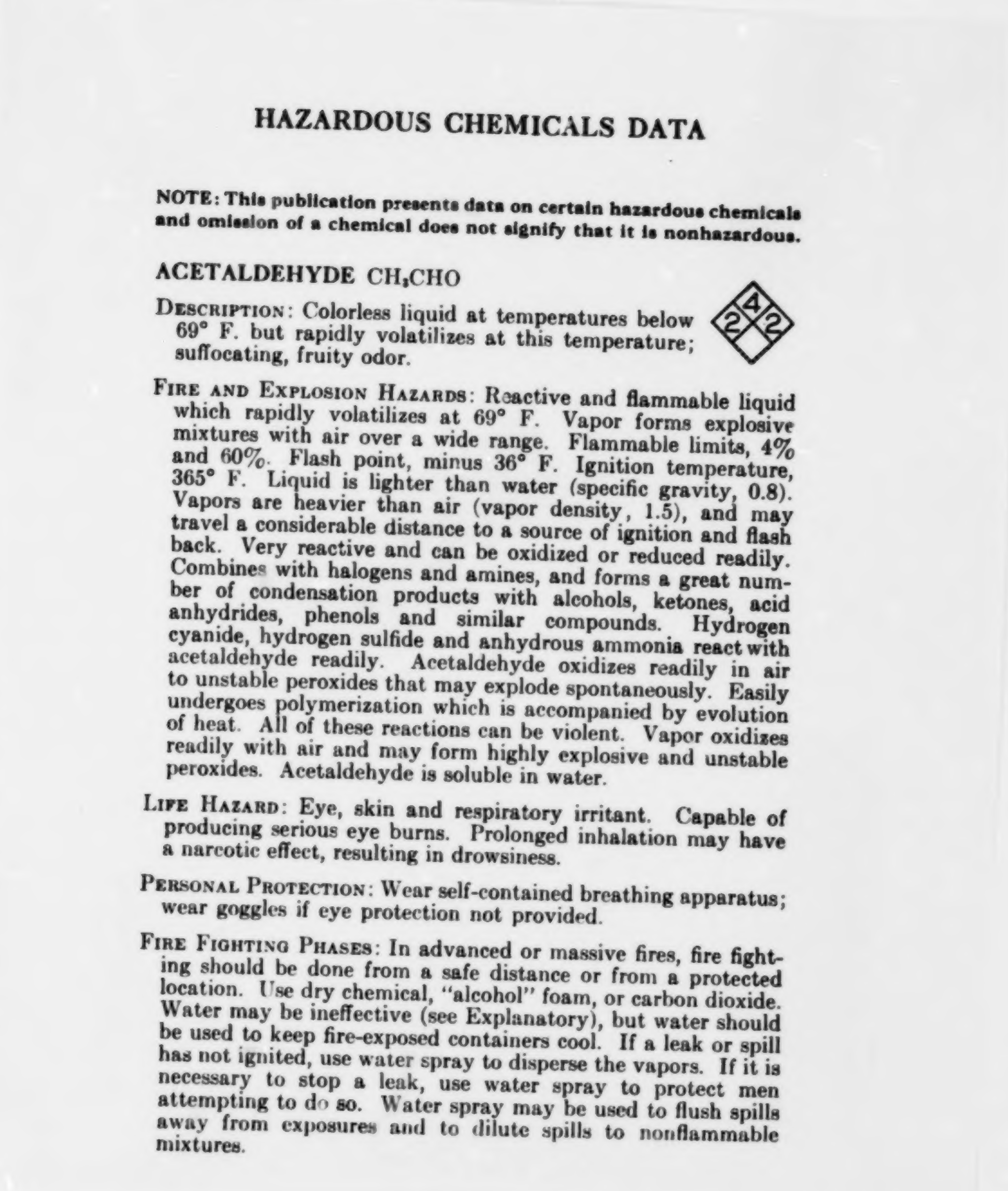
**Boldface numbers indicate NFPA numerical designation for each standard.*

Figure A-18. Table of contents National Fire Codes - Volume 3 (17).

| *Titles* | *Pages** |
|---|---|
| **Aluminum Powder,** Prevention of Dust Explosions in the Manufacture of (ANSI Z12.11) | **651–1** |
| **Magnesium Powder or Dust,** Explosion and Fire Protection in Plants Producing or Handling (ANSI Z12.15) | **652–1** |
| **Coal Preparation Plants,** Prevention of Dust Explosions in (ANSI Z12.7) | **653–1** |
| **Plastics Industry,** Prevention of Dust Explosions in the (ANSI Z12.16) | **654–1** |
| **Sulfur Fires and Explosions,** Prevention of (ANSI Z12.12) | **655–1** |
| **Spice Grinding Plants,** Prevention of Dust Ignitions in (ANSI Z12.9) | **656–1** |
| **Confectionery Manufacturing Plants,** Prevention of Dust Explosions in (ANSI Z12.18) | **657–1** |
| **Pneumatic Conveying Systems for Handling Feed, Flour, Grain, and Other Agricultural Dusts** (ANSI Z12.22) | **66–1** |
| **Woodworking and Wood Flour Manufacturing Plants,** Prevention of Dust Explosions in (ANSI Z12.20) | **664–1** |
| **Fire Tests for Flame-Resistant Textiles and Films,** Performance Requirements Under Recommended Test Methods | **701–1** |
| **Flammability of Wearing Apparel,** Classification of | **702–1** |

**Boldface numbers indicate NFPA numerical designation for each standard.*

Figure A-18. (continued).



## HAZARDOUS CHEMICALS DATA

**NOTE: This publication presents data on certain hazardous chemicals and omission of a chemical does not signify that it is nonhazardous.**

### ACETALDEHYDE $CH_3CHO$

**Description**: Colorless liquid at temperatures below 69° F. but rapidly volatilizes at this temperature; suffocating, fruity odor.

**Fire and Explosion Hazards**: Reactive and flammable liquid which rapidly volatilizes at 69° F. Vapor forms explosive mixtures with air over a wide range. Flammable limits, 4% and 60%. Flash point, minus 36° F. Ignition temperature, 365° F. Liquid is lighter than water (specific gravity, 0.8). Vapors are heavier than air (vapor density, 1.5), and may travel a considerable distance to a source of ignition and flash back. Very reactive and can be oxidized or reduced readily. Combines with halogens and amines, and forms a great number of condensation products with alcohols, ketones, acid anhydrides, phenols and similar compounds. Hydrogen cyanide, hydrogen sulfide and anhydrous ammonia react with acetaldehyde readily. Acetaldehyde oxidizes readily in air to unstable peroxides that may explode spontaneously. Easily undergoes polymerization which is accompanied by evolution of heat. All of these reactions can be violent. Vapor oxidizes readily with air and may form highly explosive and unstable peroxides. Acetaldehyde is soluble in water.

**Life Hazard**: Eye, skin and respiratory irritant. Capable of producing serious eye burns. Prolonged inhalation may have a narcotic effect, resulting in drowsiness.

**Personal Protection**: Wear self-contained breathing apparatus; wear goggles if eye protection not provided.

**Fire Fighting Phases**: In advanced or massive fires, fire fighting should be done from a safe distance or from a protected location. Use dry chemical, "alcohol" foam, or carbon dioxide. Water may be ineffective (see Explanatory), but water should be used to keep fire-exposed containers cool. If a leak or spill has not ignited, use water spray to disperse the vapors. If it is necessary to stop a leak, use water spray to protect men attempting to do so. Water spray may be used to flush spills away from exposures and to dilute spills to nonflammable mixtures.

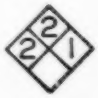
Figure A-19. Typical entry National Fire Codes - Volume 3 (17).

**Usual Shipping Containers**: One-quart glass pressure bottles, 5- to 55-gallon metal drums, insulated tank cars and insulated tank trucks, tank barges.

**Storage**: Protect against physical damage. Store bulk quantities outside in detached tanks provided with refrigeration and inert gas blanket, such as nitrogen, in void space above liquid level. Smaller container storage should be in a detached noncombustible building, provided with cooling facilities, adequate ventilation and free of sources of ignition; no alkaline materials (such as caustics, ammonia, amines), halogens, alcohols, ketones, acid anhydrides, phenols, nor oxidizing materials, permitted in storage room. Inside storage should be in a standard flammable liquids storage room or cabinet. Isolate from other storage.

**Remarks**: Electrical installations in Class I hazardous locations, as defined in Article 500 of the National Electrical Code, should be in accordance with Article 501 of the Code. If explosionproof electrical equipment is necessary, it shall be suitable for use in Group C. See Flammable and Combustible Liquids Code (NFPA No. 30), National Electrical Code (NFPA No. 70), Static Electricity (NFPA No. 77), Lightning Protection Code (NFPA No. 78), Fire-Hazard Properties of Flammable Liquids, Gases and Volatile Solids (NFPA No. 325M), and Chemical Safety Data Sheet SD-43 (Manufacturing Chemists' Association, Inc.).

## ACETIC ACID (Glacial) $CH_3COOH$



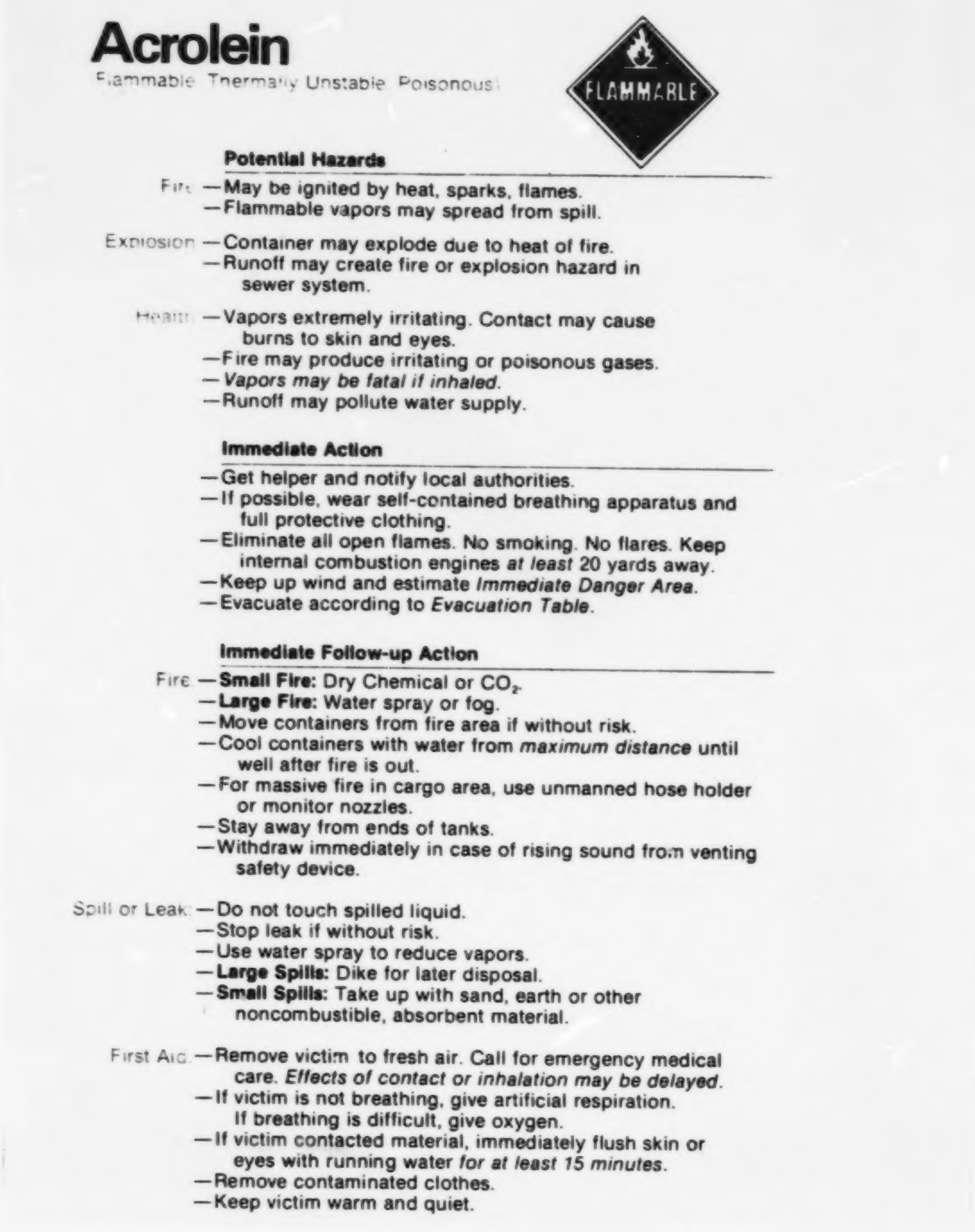
**Description**: A clear, colorless liquid with strong pungent odor of vinegar.

**Fire and Explosion Hazards**: Gives off flammable vapor above its flash point, 109° F. Vapor forms explosive mixtures with air. Dangerous in contact with chromic acid, sodium peroxide, nitric acid, or other oxidizing materials. Soluble in water.

**Life Hazard**: May produce severe acid burns to skin and eyes Prolonged breathing of concentrated vapor may be harmful. Glacial acetic acid contracts upon freezing (specific gravity of liquid at 62.1° F is 1.05 and of the solid at 62° F is 1.27).

**Personal Protection**: Wear self-contained breathing apparatus; wear goggles if eye protection not provided.

Figure A-19. (continued).



## Acrolein

(Flammable, Thermally Unstable, Poisonous)

**Potential Hazards**

Fire —May be ignited by heat, sparks, flames.
—Flammable vapors may spread from spill.

Explosion —Container may explode due to heat of fire.
—Runoff may create fire or explosion hazard in sewer system.

Health —Vapors extremely irritating. Contact may cause burns to skin and eyes.
—Fire may produce irritating or poisonous gases.
—*Vapors may be fatal if inhaled.*
—Runoff may pollute water supply.

**Immediate Action**

—Get helper and notify local authorities.
—If possible, wear self-contained breathing apparatus and full protective clothing.
—Eliminate all open flames. No smoking. No flares. Keep internal combustion engines *at least* 20 yards away.
—Keep up wind and estimate *Immediate Danger Area.*
—Evacuate according to *Evacuation Table.*

**Immediate Follow-up Action**

Fire —**Small Fire:** Dry Chemical or $CO_2$.
—**Large Fire:** Water spray or fog.
—Move containers from fire area if without risk.
—Cool containers with water from *maximum distance* until well after fire is out.
—For massive fire in cargo area, use unmanned hose holder or monitor nozzles.
—Stay away from ends of tanks.
—Withdraw immediately in case of rising sound from venting safety device.

Spill or Leak —Do not touch spilled liquid.
—Stop leak if without risk.
—Use water spray to reduce vapors.
—**Large Spills:** Dike for later disposal.
—**Small Spills:** Take up with sand, earth or other noncombustible, absorbent material.

First Aid —Remove victim to fresh air. Call for emergency medical care. *Effects of contact or inhalation may be delayed.*
—If victim is not breathing, give artificial respiration. If breathing is difficult, give oxygen.
—If victim contacted material, immediately flush skin or eyes with running water *for at least 15 minutes.*
—Remove contaminated clothes.
—Keep victim warm and quiet.

Figure A-20. Typical entry from Hazardous Materials - Emergency Action Guide (18).

**Additional Follow-up Action**

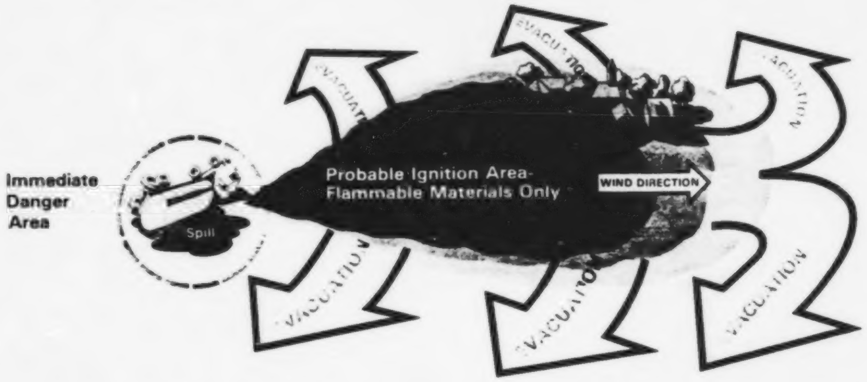
—For more detailed assistance in controlling the hazard, call Chemtrec (Chemical Transportation Emergency Center) toll free (800) 424-9300. You will be asked for the following information:

- Your location and phone number.
- Location of the accident.
- Name of product and shipper, if known.
- The color and number on any labels on the carrier or cargo.
- Weather conditions.
- Type of environment (populated, rural, business, etc.)
- Availability of water supply.

—Adjust evacuation area according to wind changes and observed effect on population.

**Water Pollution Control**

—Prevent runoff from fire control or dilution water from entering streams or drinking water supply. Dike for later disposal. Notify Coast Guard or Environmental Protection Agency of the situation through Chemtrec or your local authorities.



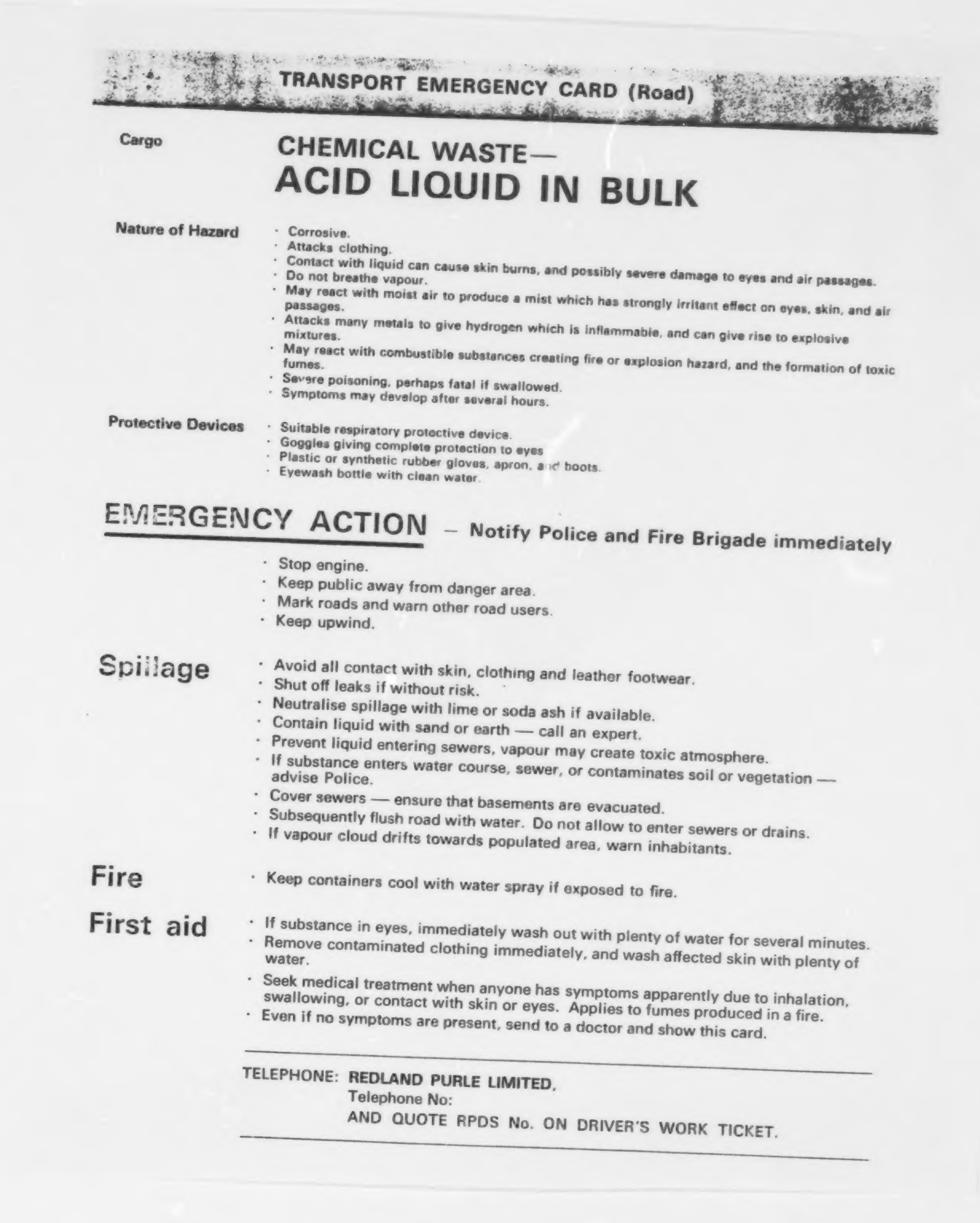
Immediate Danger Area
Spill
Probable Ignition Area-
Flammable Materials Only
WIND DIRECTION
EVACUATION
EVACUATION
EVACUATION
EVACUATION
EVACUATION
EVACUATION

**Evacuation Table — Based on Prevailing Wind of 6-12 mph.**

| Approximate Size of Spill | Distance to Evacuate From Immediate Danger Area | For Maximum Safety, Downwind Evacuation Area Should Be |
|---|---|---|
| 200 square feet | 360 yards (432 paces) | 2 miles long, 1 mile wide |
| 400 square feet | 530 yards (636 paces) | 3 miles long, 2 miles wide |
| 600 square feet | 650 yards (780 paces) | 4 miles long, 2 1/2 miles wide |
| 800 square feet | 760 yards (912 paces) | 5 miles long, 3 miles wide |

In the event of an explosion, the minimum safe distance from flying fragments is 2,000 feet in all directions.

Figure A-20. (continued).



**TRANSPORT EMERGENCY CARD (Road)**

**Cargo** **CHEMICAL WASTE—**
**ACID LIQUID IN BULK**

**Nature of Hazard**

- Corrosive.
- Attacks clothing.
- Contact with liquid can cause skin burns, and possibly severe damage to eyes and air passages.
- Do not breathe vapour.
- May react with moist air to produce a mist which has strongly irritant effect on eyes, skin, and air passages.
- Attacks many metals to give hydrogen which is inflammable, and can give rise to explosive mixtures.
- May react with combustible substances creating fire or explosion hazard, and the formation of toxic fumes.
- Severe poisoning, perhaps fatal if swallowed.
- Symptoms may develop after several hours.

**Protective Devices**

- Suitable respiratory protective device.
- Goggles giving complete protection to eyes
- Plastic or synthetic rubber gloves, apron, and boots.
- Eyewash bottle with clean water.

**EMERGENCY ACTION** – **Notify Police and Fire Brigade immediately**

- Stop engine.
- Keep public away from danger area.
- Mark roads and warn other road users.
- Keep upwind.

**Spillage**

- Avoid all contact with skin, clothing and leather footwear.
- Shut off leaks if without risk.
- Neutralise spillage with lime or soda ash if available.
- Contain liquid with sand or earth — call an expert.
- Prevent liquid entering sewers, vapour may create toxic atmosphere.
- If substance enters water course, sewer, or contaminates soil or vegetation — advise Police.
- Cover sewers — ensure that basements are evacuated.
- Subsequently flush road with water. Do not allow to enter sewers or drains.
- If vapour cloud drifts towards populated area, warn inhabitants.

**Fire**

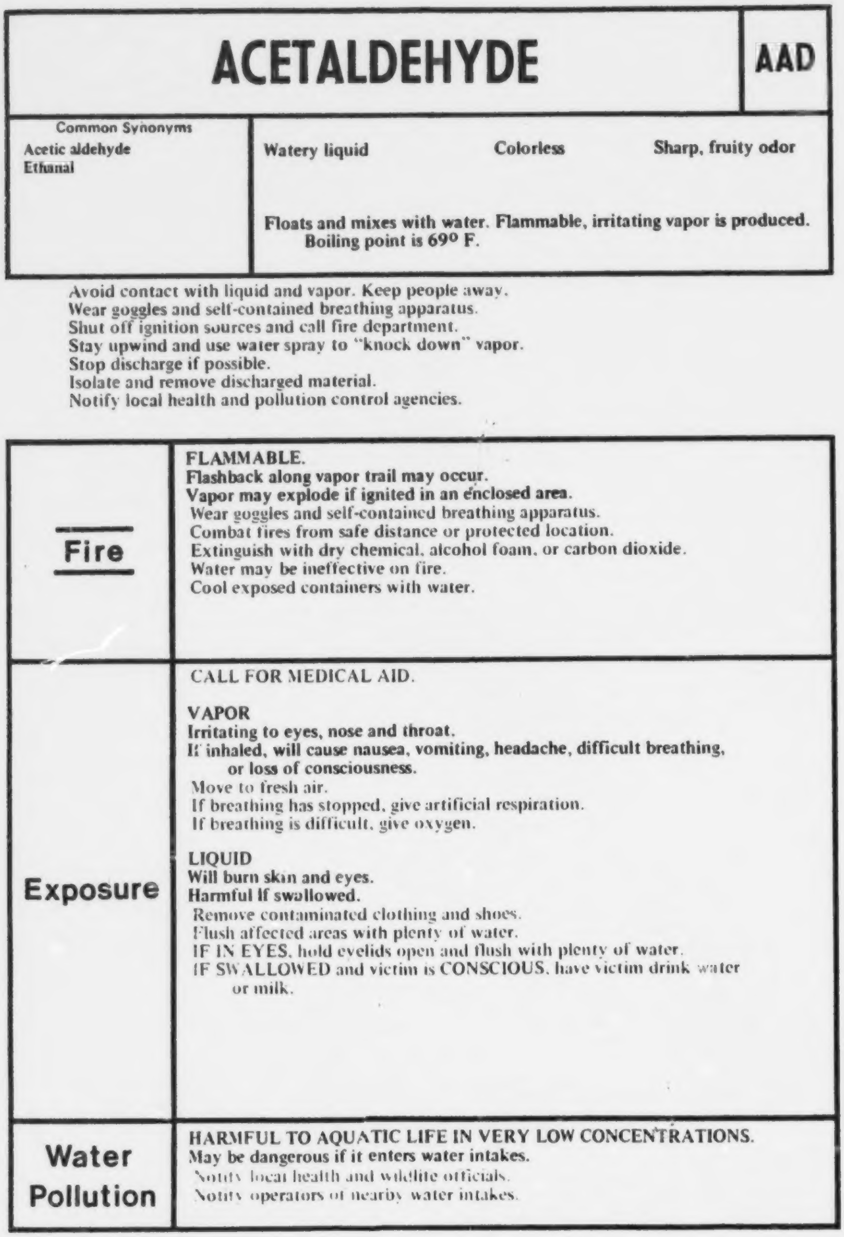
- Keep containers cool with water spray if exposed to fire.

**First aid**

- If substance in eyes, immediately wash out with plenty of water for several minutes.
- Remove contaminated clothing immediately, and wash affected skin with plenty of water.
- Seek medical treatment when anyone has symptoms apparently due to inhalation, swallowing, or contact with skin or eyes. Applies to fumes produced in a fire.
- Even if no symptoms are present, send to a doctor and show this card.

TELEPHONE: **REDLAND PURLE LIMITED,**
Telephone No:
AND QUOTE RPDS No. ON DRIVER'S WORK TICKET.

Figure A-21. Example tremcard (22).



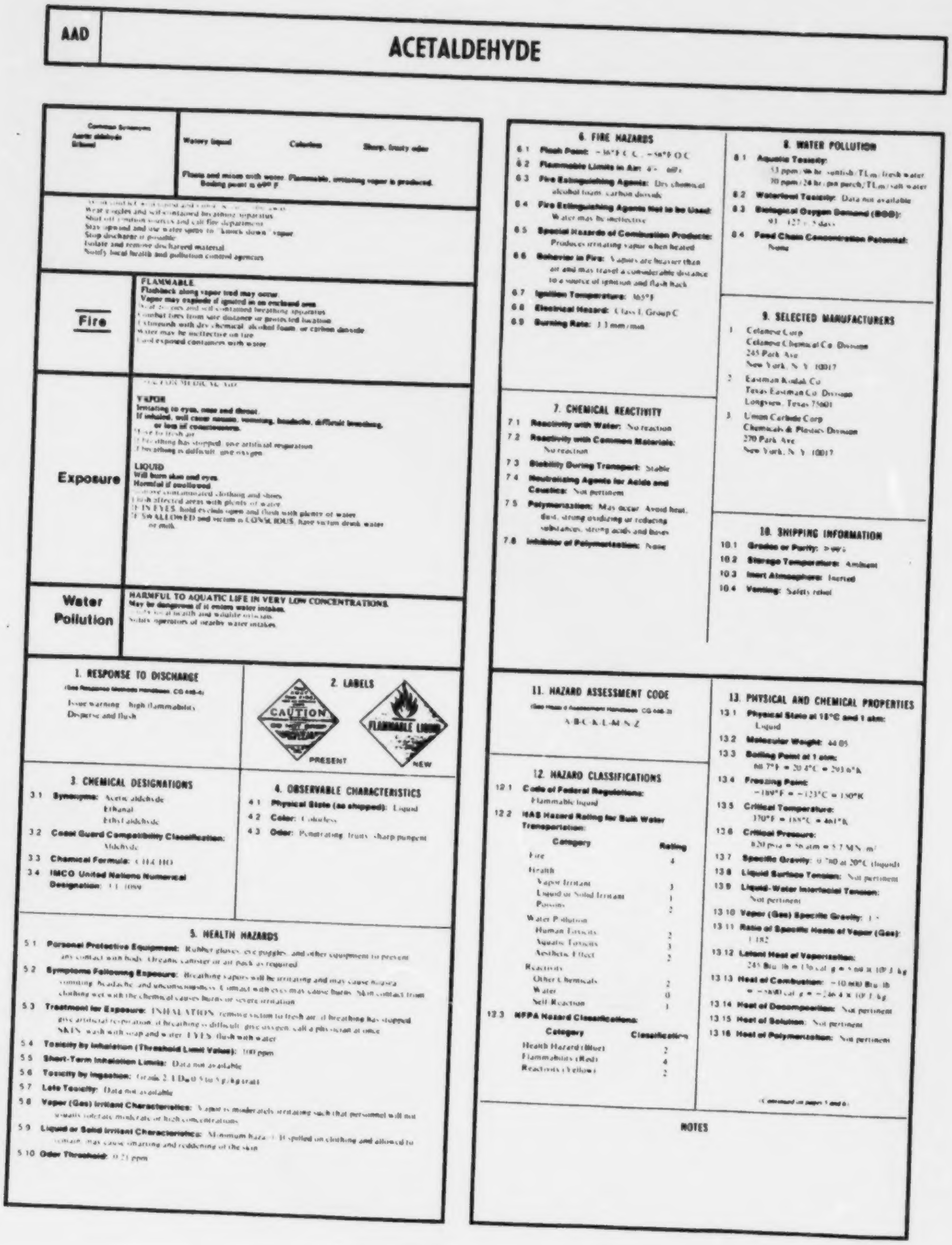
| **ACETALDEHYDE** | **AAD** |
|---|---|

| Common Synonyms | | | |
|---|---|---|---|
| Acetic aldehyde<br>Ethanal | **Watery liquid** | **Colorless** | **Sharp, fruity odor** |
| | **Floats and mixes with water. Flammable, irritating vapor is produced. Boiling point is 69° F.** | | |

Avoid contact with liquid and vapor. Keep people away.
Wear goggles and self-contained breathing apparatus.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

| | |
|---|---|
| **Fire** | **FLAMMABLE.**<br>**Flashback along vapor trail may occur.**<br>**Vapor may explode if ignited in an enclosed area.**<br>Wear goggles and self-contained breathing apparatus.<br>Combat fires from safe distance or protected location.<br>Extinguish with dry chemical, alcohol foam, or carbon dioxide.<br>Water may be ineffective on fire.<br>Cool exposed containers with water. |
| **Exposure** | CALL FOR MEDICAL AID.<br>**VAPOR**<br>**Irritating to eyes, nose and throat.**<br>**If inhaled, will cause nausea, vomiting, headache, difficult breathing, or loss of consciousness.**<br>Move to fresh air.<br>If breathing has stopped, give artificial respiration.<br>If breathing is difficult, give oxygen.<br>**LIQUID**<br>**Will burn skin and eyes.**<br>**Harmful if swallowed.**<br>Remove contaminated clothing and shoes.<br>Flush affected areas with plenty of water.<br>IF IN EYES, hold eyelids open and flush with plenty of water.<br>IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. |
| **Water Pollution** | **HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.**<br>**May be dangerous if it enters water intakes.**<br>Notify local health and wildlife officials.<br>Notify operators of nearby water intakes. |

Figure A-22. Typical entry from CHRIS Volume I (23).



AAD

# ACETALDEHYDE

Common Synonyms
Acetic aldehyde
Ethanal

Watery liquid　Colorless　Sharp, fruity odor

Floats and mixes with water. Flammable, irritating vapor is produced.
Boiling point is 69° F.

Avoid contact with liquid and vapor. Keep people away.
Wear goggles and self-contained breathing apparatus.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

**Fire**

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Combat fires from safe distance or protected location.
Extinguish with dry chemical, alcohol foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

**Exposure**

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea, vomiting, headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

**Water Pollution**

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

### 1. RESPONSE TO DISCHARGE

(See Response Methods Handbook, CG-446-4)

Issue warning - high flammability
Disperse and flush

### 2. LABELS

PRESENT　NEW

### 3. CHEMICAL DESIGNATIONS

3.1 **Synonyms:** Acetic aldehyde
Ethanal
Ethyl aldehyde
3.2 **Coast Guard Compatibility Classification:** Aldehyde
3.3 **Chemical Formula:** $CH_3CHO$
3.4 **IMCO United Nations Numerical Designation:** 3.1/1089

### 4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Penetrating, fruity, sharp pungent

### 5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Rubber gloves, eye goggles, and other equipment to prevent any contact with body. Organic canister or air pack as required.
5.2 **Symptoms Following Exposure:** Breathing vapors will be irritating and may cause nausea, vomiting, headache, and unconsciousness. Contact with eyes may cause burns. Skin contact from clothing wet with the chemical causes burns or severe irritation.
5.3 **Treatment for Exposure:** INHALATION: remove victim to fresh air; if breathing has stopped give artificial respiration; if breathing is difficult, give oxygen; call a physician at once. SKIN: wash with soap and water. EYES: flush with water.
5.4 **Toxicity by Inhalation (Threshold Limit Value):** 100 ppm
5.5 **Short-Term Inhalation Limits:** Data not available
5.6 **Toxicity by Ingestion:** Grade 2; LD50 0.5 to 5 g/kg (rat)
5.7 **Late Toxicity:** Data not available
5.8 **Vapor (Gas) Irritant Characteristics:** Vapor is moderately irritating such that personnel will not usually tolerate moderate or high concentrations.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 0.21 ppm

### 6. FIRE HAZARDS

6.1 **Flash Point:** −36°F C.C.; −38°F O.C.
6.2 **Flammable Limits in Air:** 4%–60%
6.3 **Fire Extinguishing Agents:** Dry chemical, alcohol foam, carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective
6.5 **Special Hazards of Combustion Products:** Produces irritating vapor when heated
6.6 **Behavior in Fire:** Vapors are heavier than air and may travel a considerable distance to a source of ignition and flash back
6.7 **Ignition Temperature:** 365°F
6.8 **Electrical Hazard:** Class I, Group C
6.9 **Burning Rate:** 3.3 mm/min

### 7. CHEMICAL REACTIVITY

7.1 **Reactivity with Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** May occur. Avoid heat, dust, strong oxidizing or reducing substances, strong acids and bases
7.6 **Inhibitor of Polymerization:** None

### 8. WATER POLLUTION

8.1 **Aquatic Toxicity:**
53 ppm/96 hr/sunfish/TLm/fresh water
70 ppm/24 hr/pin perch/TLm/salt water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 91–127%, 5 days
8.4 **Food Chain Concentration Potential:** None

### 9. SELECTED MANUFACTURERS

1. Celanese Corp.
Celanese Chemical Co. Division
245 Park Ave.
New York, N. Y. 10017
2. Eastman Kodak Co.
Texas Eastman Co. Division
Longview, Texas 75601
3. Union Carbide Corp.
Chemicals & Plastics Division
270 Park Ave.
New York, N. Y. 10017

### 10. SHIPPING INFORMATION

10.1 **Grades or Purity:** >99%
10.2 **Storage Temperature:** Ambient
10.3 **Inert Atmosphere:** Inerted
10.4 **Venting:** Safety relief

### 11. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook, CG-446-3)

A-B-C-K-L-M-N-Z

### 12. HAZARD CLASSIFICATIONS

12.1 **Code of Federal Regulations:** Flammable liquid
12.2 **NAS Hazard Rating for Bulk Water Transportation:**

| Category | Rating |
|---|---|
| Fire | 4 |
| Health | |
| Vapor Irritant | 3 |
| Liquid or Solid Irritant | 1 |
| Poisons | 2 |
| Water Pollution | |
| Human Toxicity | 2 |
| Aquatic Toxicity | 3 |
| Aesthetic Effect | 2 |
| Reactivity | |
| Other Chemicals | 2 |
| Water | 0 |
| Self Reaction | 1 |

12.3 **NFPA Hazard Classifications:**

| Category | Classification |
|---|---|
| Health Hazard (Blue) | 2 |
| Flammability (Red) | 4 |
| Reactivity (Yellow) | 2 |

### 13. PHYSICAL AND CHEMICAL PROPERTIES

13.1 **Physical State at 15°C and 1 atm:** Liquid
13.2 **Molecular Weight:** 44.05
13.3 **Boiling Point at 1 atm:** 68.7°F = 20.4°C = 293.6°K
13.4 **Freezing Point:** −189°F = −123°C = 150°K
13.5 **Critical Temperature:** 370°F = 188°C = 461°K
13.6 **Critical Pressure:** 820 psia = 56 atm = 5.7 MN/m²
13.7 **Specific Gravity:** 0.780 at 20°C (liquid)
13.8 **Liquid Surface Tension:** Not pertinent
13.9 **Liquid-Water Interfacial Tension:** Not pertinent
13.10 **Vapor (Gas) Specific Gravity:** 1.5
13.11 **Ratio of Specific Heats of Vapor (Gas):** 1.182
13.12 **Latent Heat of Vaporization:** 245 Btu/lb = 136 cal/g = 5.69 × 10⁵ J/kg
13.13 **Heat of Combustion:** −10,600 Btu/lb = −5890 cal/g = −246.4 × 10⁵ J/kg
13.14 **Heat of Decomposition:** Not pertinent
13.15 **Heat of Solution:** Not pertinent
13.16 **Heat of Polymerization:** Not pertinent

(Continued on pages 5 and 6)

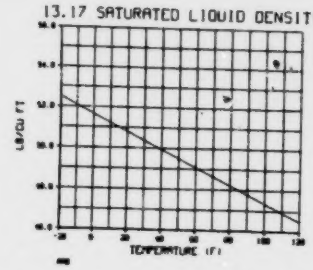
NOTES

Figure A-23. Typical entry from CHRIS - Volume 2 (23).

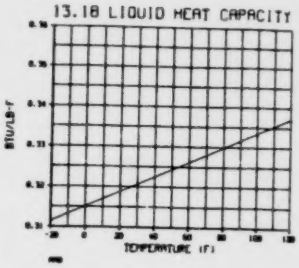
## ACETALDEHYDE

**AAD**

13.17 SATURATED LIQUID DENSITY



13.18 LIQUID HEAT CAPACITY



13.19 LIQUID THERMAL CONDUCTIVITY

NOT PERTINENT

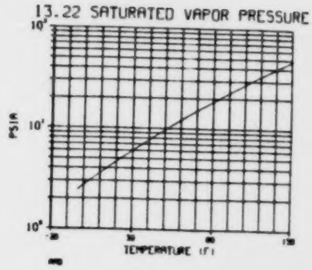
13.20 LIQUID VISCOSITY

NOT PERTINENT

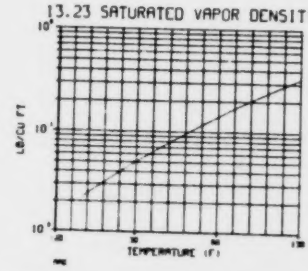
13.21 SOLUBILITY IN WATER

MISCIBLE

13.22 SATURATED VAPOR PRESSURE



13.23 SATURATED VAPOR DENSITY



13.24 IDEAL GAS HEAT CAPACITY

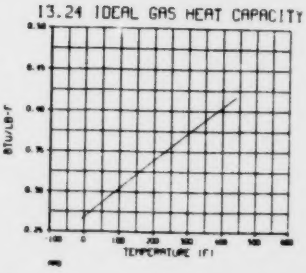


Figure A-23. (continued).

*1. TADS Accession No.
2. Material Name
3. Synonyms
4. Trade Names
5. Chemical Formula
*6. Species in Mixture
7. SIC Code
8. Common Uses
*9. Rail (%)
*10. Barge (%)
*11. Truck (%)
*12. Pipeline (%)
13. Containers
14. Shipment Size
15. General Storage Procedures
*16. General Handling Procedures
*17. Personal Safety Precautions
18. Production Sites
*19. Use Areas
20. Hydrolysis Product Of
*21. % Additive
22. Flammability
23. Explosiveness
24. Air Pollution
*25. Action Levels
*26. Field Detection, Limit (ppm) Techniques
*27. Laboratory Detection Limit (ppm), Techniques
28. Major Hazards
29. Standard Codes
30. Melting Point (°C)
31. Melting Characteristics
32. Boiling Point (°C)
33. Boiling Characteristics
34. Solubility (ppm 25°C)
35. Solubility Characteristics
36. Specific Gravity
37. Probable location and state of material
38. Binary Reactants
39. Lower Flammability Limit (%)
40. Upper Flammability Limit (%)

(Asterisk indicates non-searchable components, for display only)

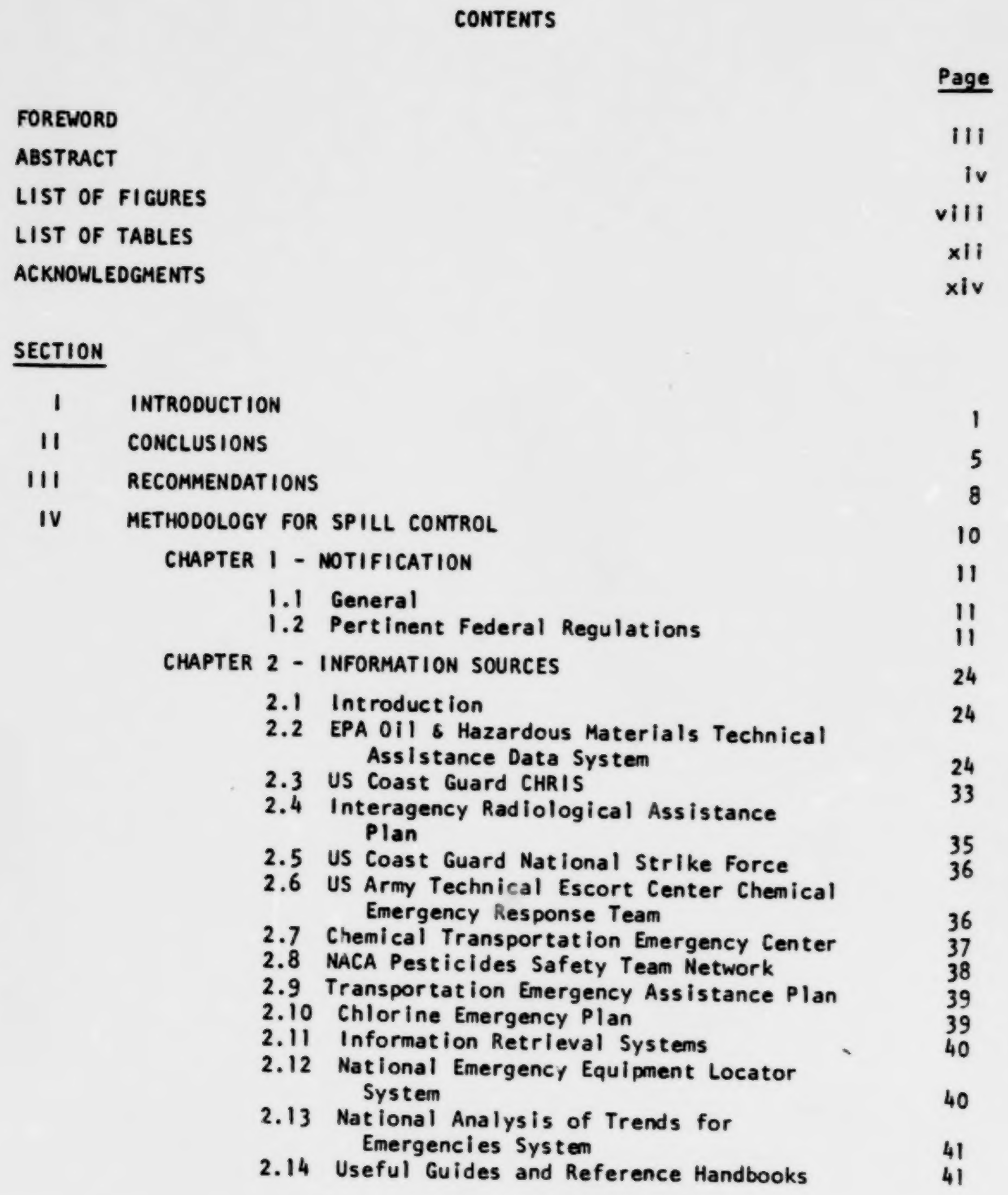
Figure A-24. Listing of subject headings for OHM-TADS (24).

41. Toxic Combustion Products
42. Extinguishing Methods
43. Lower Explosive Limit (%)
44. Upper Explosive Limit (%)
45. Flash Point (°C)
46. Auto Ignition Point (°C)
47. Inhalation Limit (Value)
48. Inhalation Limit (Text)
49. Irritation Levels (Value)
50. Irritation Levels (Text)
51. Direct Contact
52. General Sensation
53. Lower Odor Threshold (ppm)
54. Lower Odor Threshold (Text)
55. Medium Odor Threshold (ppm)
56. Medium Odor Threshold (Text)
57. Upper Odor Threshold (ppm)
58. Upper Odor Threshold (Text)
59. Lower Taste Threshold (ppm)
60. Lower Taste Threshold (Text)
61. Medium Taste Threshold (ppm)
62. Medium Taste Threshold (Text)
63. Upper Taste Threshold (ppm)
64. Upper Taste Threshold (Text)
65. Corrosiveness
66. Synergistic Materials
67. Antagonistic Materials
68. Degree of Hazard to Public Health
69. Exchange Capacity with Natural Soils
70. Industrial Fouling Potential
71. Effect on Water Treatment Process
72. Direct Human Ingestion (mg/kg wt)
*73. Reference for Direct Human Ingestion
74. Recommended Drinking Water Limits (ppm)
*75. Reference for Recommended Drinking Water Limits
76. Body Contact Exposure (ppm)
*77. Reference for Body Contact Exposure
78. Fresh Water Toxicity
79. Limiting Water Quality
80. Salt Water Toxicity
81. Animal Toxicity
82. Livestock Toxicity (ppm)
*83. Reference for Livestock
84. Waterfowl (ppm)

Figure A-24. (continued).

*85. Reference for Waterfowl
86. Aquatic Plants (ppm)
*87. Reference for Aquatic Plants
88. Irrigable Plants (ppm)
*89. Reference for Irrigable Plants
90. Major Species Threatened
91. Acute Hazard Level
92. Etiological Potential
93. Emergency Water Quality Std (ppm)
94. Prolonged Human Contact (ppm)
*95. Reference for Prolonged Human Contact
96. Potential for Accumulation
97. Chronic Aquatic Toxicity Limits (ppm)
*98. Reference for Chronic Aquatic Toxic Limit
99. Taste Imparting Characteristics (ppm)
*100. Reference for Taste Imparting Characteristics
101. Chronic Animal Toxicity Limits (ppm)
*102. Reference for Chronic Animal Toxicity Limits
103. Chronic Waterfowl Toxicity Limits (ppm)
*104. Ref. for Chronic Waterfowl Toxicity Limits
105. Chronic Plant Toxicity Limits (ppm)
*106. Ref. for Chronic Plant Toxicity Limits
107. Soil Transformation Properties
108. BOD (lb/lb)
109. In Situ Amelioration
110. Beach and Shore Restoration
*111. Availability of Countermeasure Material
112. Disposal Methods
*113. Disposal Notification
114. Chronic Hazard Level
115. Food Chain Concentration Potential
116. Persistency
117. Major Water Uses Threatened
118. Adequacy of Data
119. Carcinogenicity
120. Mutagenicity
121. Teratogenicity
122. Color in Water
123. Fields Containing Data

Figure A-24. (continued).



CONTENTS

Page

FOREWORD iii
ABSTRACT iv
LIST OF FIGURES viii
LIST OF TABLES xii
ACKNOWLEDGMENTS xiv

SECTION

I INTRODUCTION 1
II CONCLUSIONS 5
III RECOMMENDATIONS 8
IV METHODOLOGY FOR SPILL CONTROL 10
CHAPTER 1 - NOTIFICATION 11
1.1 General 11
1.2 Pertinent Federal Regulations 11
CHAPTER 2 - INFORMATION SOURCES 24
2.1 Introduction 24
2.2 EPA Oil & Hazardous Materials Technical Assistance Data System 24
2.3 US Coast Guard CHRIS 33
2.4 Interagency Radiological Assistance Plan 35
2.5 US Coast Guard National Strike Force 36
2.6 US Army Technical Escort Center Chemical Emergency Response Team 36
2.7 Chemical Transportation Emergency Center 37
2.8 NACA Pesticides Safety Team Network 38
2.9 Transportation Emergency Assistance Plan 39
2.10 Chlorine Emergency Plan 39
2.11 Information Retrieval Systems 40
2.12 National Emergency Equipment Locator System 40
2.13 National Analysis of Trends for Emergencies System 41
2.14 Useful Guides and Reference Handbooks 41

Figure A-25. Table of contents from Manual for Control of Hazardous Material Spills - Volume 1.

## CONTENTS (continued)

SECTION Page

CHAPTER 3 - IDENTIFICATION AND ASSESSMENT 45

3.1 General 45
3.2 Directions for the First Man on Scene 45
3.3 Directions for the OSC 65

CHAPTER 4 - DETERMINATION OF THE BEST METHOD FOR SPILL HANDLING 93

4.1 General 93
4.2 Containment of Spilled Materials 93
4.3 Collection of Spilled Materials 108
4.4 Decision on Spill Handling 117
4.5 Handling a Spill by Hauling 124
4.6 Handling by Dilution and Dispersal 125
4.7 Handling by Treatment on Site 125

CHAPTER 5 - SAFETY CONSIDERATION & PROCESS DESIGN 185

5.1 General 185
5.2 Available Equipment Sources 188
5.3 Safety Precautions 188
5.4 System Design Criteria 195

CHAPTER 6 - PROCESS CONSTRUCTION AND OPERATION 239

6.1 General 239
6.2 Filtration 239
6.3 Carbon Adsorption 253
6.4 Ion Exchange 267
6.5 Gravity Separation 281
6.6 Chemical Reaction 304

CHAPTER 7 - PROCESS COMPONENTS & TREATMENT CHEMICALS 336

7.1 General 336
7.2 Process Pumps 336
7.3 Process Tanks 359
7.4 Process Components and Flow Control 373
7.5 Chemical Feed Components 382
7.6 Air Compressors and Blowers 390
7.7 Selection of Corrosion Resistant Materials of Construction 390
7.8 Information on Treatment Chemicals 399
7.9 Suppliers Information 423
7.10 Calculation Aids and Definitions 427

Figure A-25. (continued).

CONTENTS (continued)

SECTION Page

CHAPTER 8 - STANDARD OPERATING PROCEDURES DURING CLEANUP 439

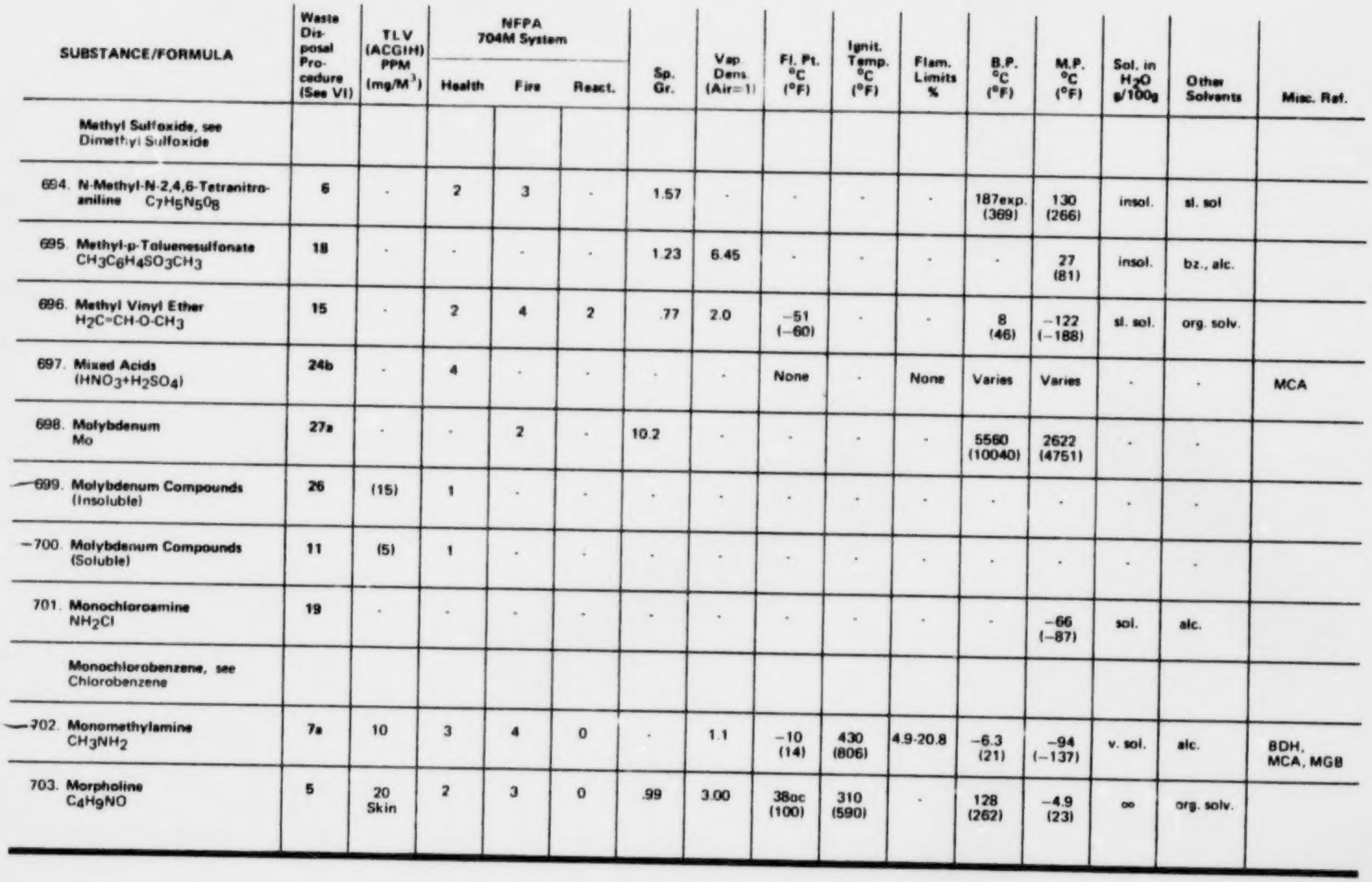
8.1 Sampling Procedures 439
8.2 Records 445

V METHODOLOGIES FOR SPILL PREVENTION 447

In Plant Prevention 447
Spill Prevention During Transport 455
Safety or Prevention Devices 462

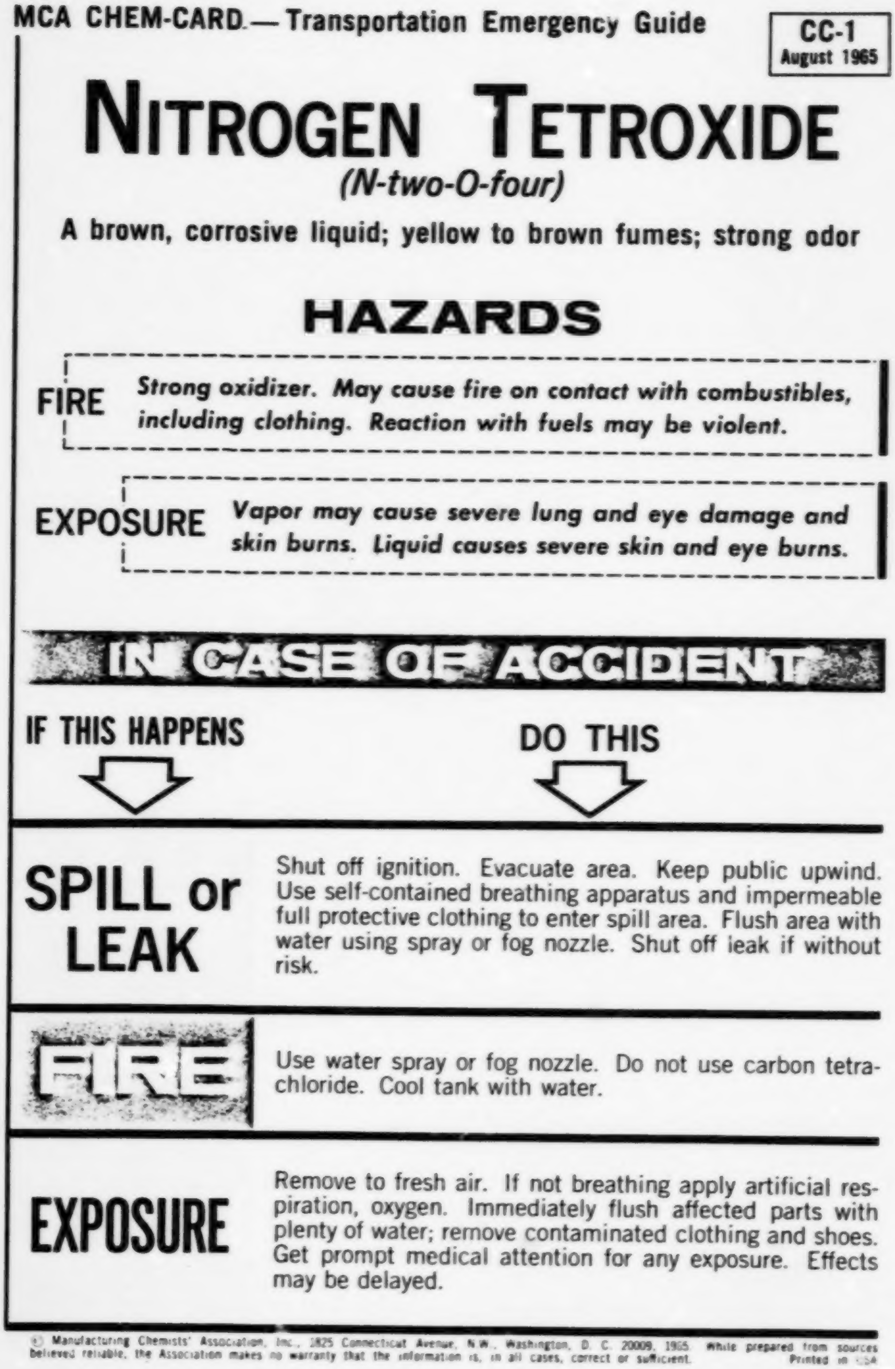
REFERENCES 467

Figure A-25. (continued).



| SUBSTANCE/FORMULA | Waste Disposal Procedure (See VI) | TLV (ACGIH) PPM (mg/M³) | NFPA 704M System | | | Sp. Gr. | Vap Dens. (Air=1) | Fl. Pt. °C (°F) | Ignit. Temp. °C (°F) | Flam. Limits % | B.P. °C (°F) | M.P. °C (°F) | Sol. in $H_2O$ g/100g | Other Solvents | Misc. Ref. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Health | Fire | React. | | | | | | | | | | |
| **Methyl Sulfoxide, see**<br>Dimethyl Sulfoxide | | | | | | | | | | | | | | | |
| 694. **N-Methyl-N-2,4,6-Tetranitroaniline** $C_7H_5N_5O_8$ | 6 | - | 2 | 3 | - | 1.57 | - | - | - | - | 187exp.<br>(369) | 130<br>(266) | insol. | sl. sol | |
| 695. **Methyl-p-Toluenesulfonate**<br>$CH_3C_6H_4SO_3CH_3$ | 18 | - | - | - | - | 1.23 | 6.45 | - | - | - | - | 27<br>(81) | insol. | bz., alc. | |
| 696. **Methyl Vinyl Ether**<br>$H_2C=CH\text{-}O\text{-}CH_3$ | 15 | - | 2 | 4 | 2 | .77 | 2.0 | −51<br>(−60) | - | - | 8<br>(46) | −122<br>(−188) | sl. sol. | org. solv. | |
| 697. **Mixed Acids**<br>$(HNO_3+H_2SO_4)$ | 24b | - | 4 | - | - | - | - | None | - | None | Varies | Varies | - | - | MCA |
| 698. **Molybdenum**<br>Mo | 27a | - | - | 2 | - | 10.2 | - | - | - | - | 5560<br>(10040) | 2622<br>(4751) | - | - | |
| 699. **Molybdenum Compounds**<br>(Insoluble) | 26 | (15) | 1 | - | - | - | - | - | - | - | - | - | - | - | |
| 700. **Molybdenum Compounds**<br>(Soluble) | 11 | (5) | 1 | - | - | - | - | - | - | - | - | - | - | - | |
| 701. **Monochloroamine**<br>$NH_2Cl$ | 19 | - | - | - | - | - | - | - | - | - | - | −66<br>(−87) | sol. | alc. | |
| **Monochlorobenzene, see**<br>Chlorobenzene | | | | | | | | | | | | | | | |
| 702. **Monomethylamine**<br>$CH_3NH_2$ | 7a | 10 | 3 | 4 | 0 | - | 1.1 | −10<br>(14) | 430<br>(806) | 4.9-20.8 | −6.3<br>(21) | −94<br>(−137) | v. sol. | alc. | BDH,<br>MCA, MGB |
| 703. **Morpholine**<br>$C_4H_9NO$ | 5 | 20<br>Skin | 2 | 3 | 0 | .99 | 3.00 | 38oc<br>(100) | 310<br>(590) | - | 128<br>(262) | −4.9<br>(23) | ∞ | org. solv. | |

Figure A-26. Typical listing from the Laboratory Disposal Manual (29).



**MCA CHEM-CARD — Transportation Emergency Guide**

**CC-1**
**August 1965**

# NITROGEN TETROXIDE

*(N-two-O-four)*

**A brown, corrosive liquid; yellow to brown fumes; strong odor**

## HAZARDS

| | |
|---|---|
| **FIRE** | ***Strong oxidizer. May cause fire on contact with combustibles, including clothing. Reaction with fuels may be violent.*** |
| **EXPOSURE** | ***Vapor may cause severe lung and eye damage and skin burns. Liquid causes severe skin and eye burns.*** |

## IN CASE OF ACCIDENT

| IF THIS HAPPENS | DO THIS |
|---|---|
| **SPILL or LEAK** | Shut off ignition. Evacuate area. Keep public upwind. Use self-contained breathing apparatus and impermeable full protective clothing to enter spill area. Flush area with water using spray or fog nozzle. Shut off leak if without risk. |
| **FIRE** | Use water spray or fog nozzle. Do not use carbon tetrachloride. Cool tank with water. |
| **EXPOSURE** | Remove to fresh air. If not breathing apply artificial respiration, oxygen. Immediately flush affected parts with plenty of water; remove contaminated clothing and shoes. Get prompt medical attention for any exposure. Effects may be delayed. |

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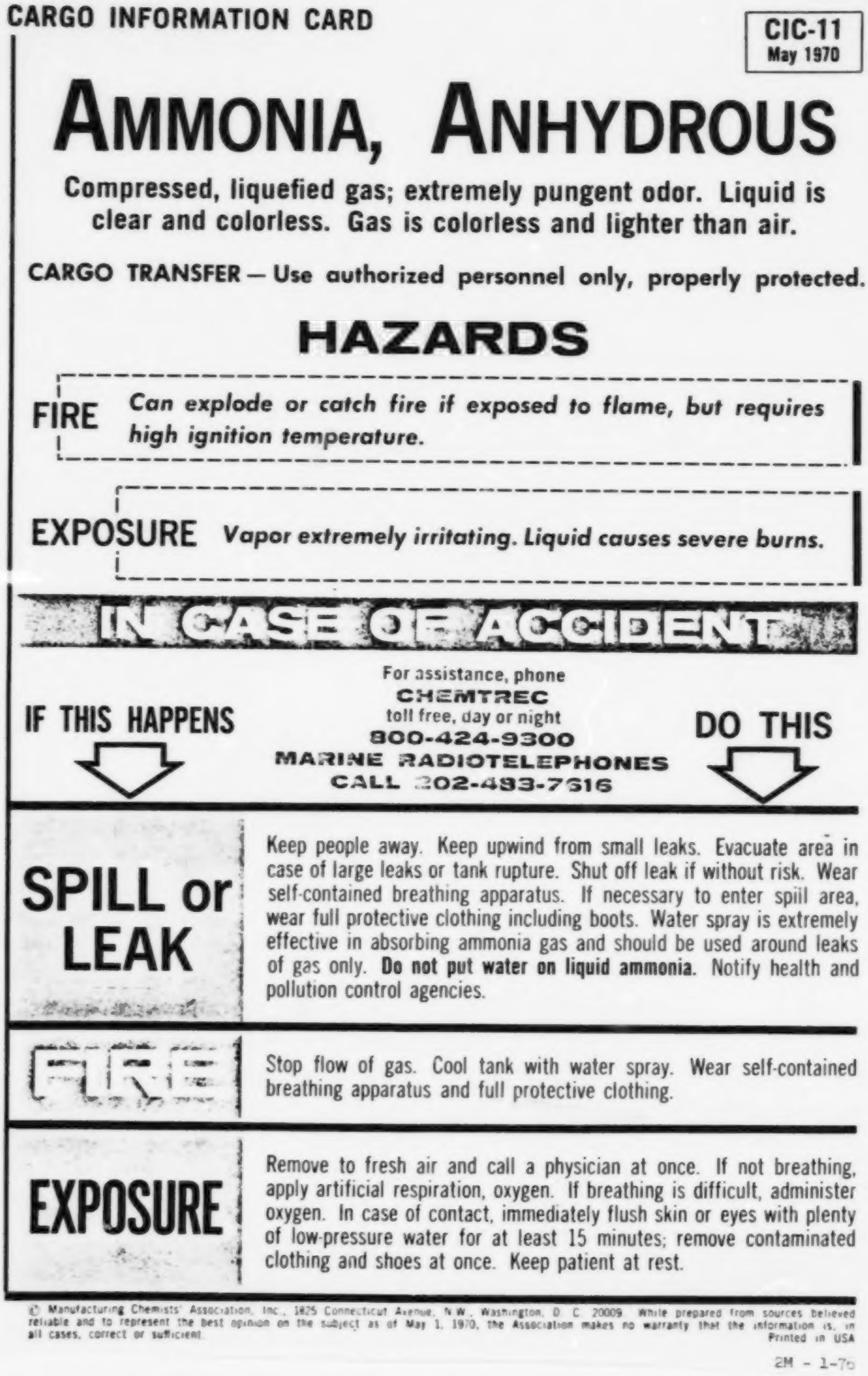
Figure A-27. Example of an MCA CHEM-Card - Transportation Emergency Guide (20).



CARGO INFORMATION CARD

**CIC-11**
**May 1970**

# AMMONIA, ANHYDROUS

**Compressed, liquefied gas; extremely pungent odor. Liquid is clear and colorless. Gas is colorless and lighter than air.**

**CARGO TRANSFER — Use authorized personnel only, properly protected.**

## HAZARDS

**FIRE** *Can explode or catch fire if exposed to flame, but requires high ignition temperature.*

**EXPOSURE** *Vapor extremely irritating. Liquid causes severe burns.*

## IN CASE OF ACCIDENT

For assistance, phone
**CHEMTREC**
toll free, day or night
**800-424-9300**
**MARINE RADIOTELEPHONES**
**CALL 202-483-7616**

| IF THIS HAPPENS | DO THIS |
|---|---|
| **SPILL or LEAK** | Keep people away. Keep upwind from small leaks. Evacuate area in case of large leaks or tank rupture. Shut off leak if without risk. Wear self-contained breathing apparatus. If necessary to enter spill area, wear full protective clothing including boots. Water spray is extremely effective in absorbing ammonia gas and should be used around leaks of gas only. **Do not put water on liquid ammonia**. Notify health and pollution control agencies. |
| **FIRE** | Stop flow of gas. Cool tank with water spray. Wear self-contained breathing apparatus and full protective clothing. |
| **EXPOSURE** | Remove to fresh air and call a physician at once. If not breathing, apply artificial respiration, oxygen. If breathing is difficult, administer oxygen. In case of contact, immediately flush skin or eyes with plenty of low-pressure water for at least 15 minutes; remove contaminated clothing and shoes at once. Keep patient at rest. |

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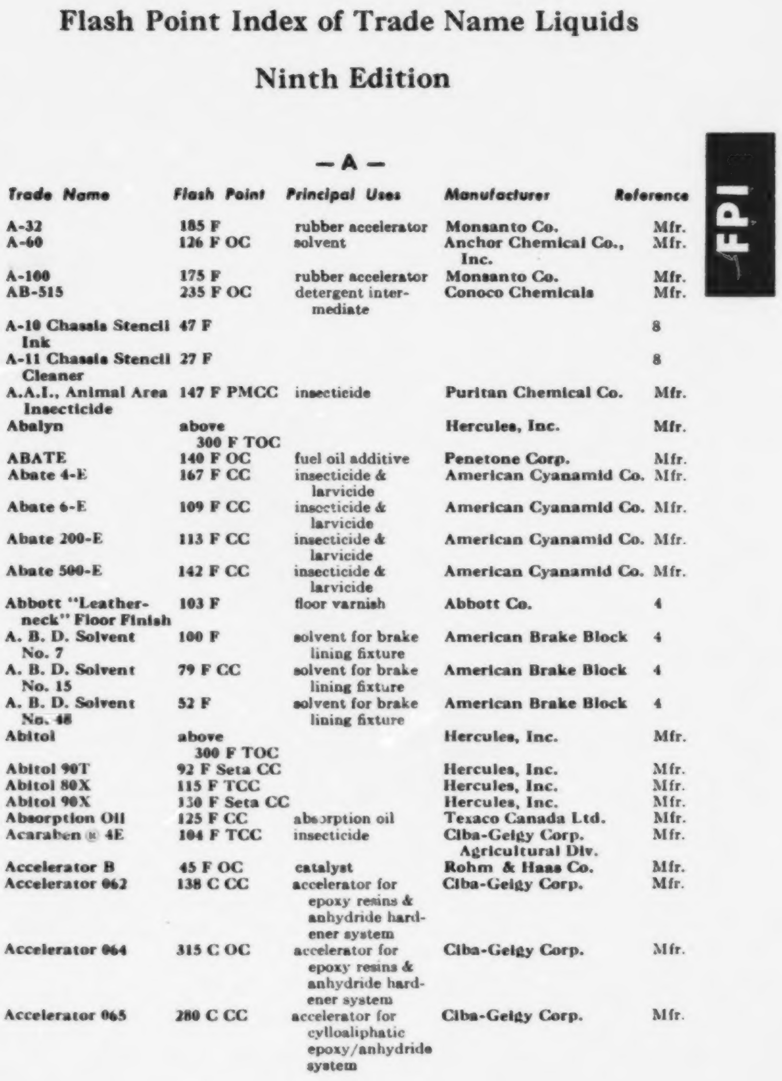
Printed in USA

2M - 1-70

Figure A-28. An example of a cargo information card (20).



## Flash Point Index of Trade Name Liquids

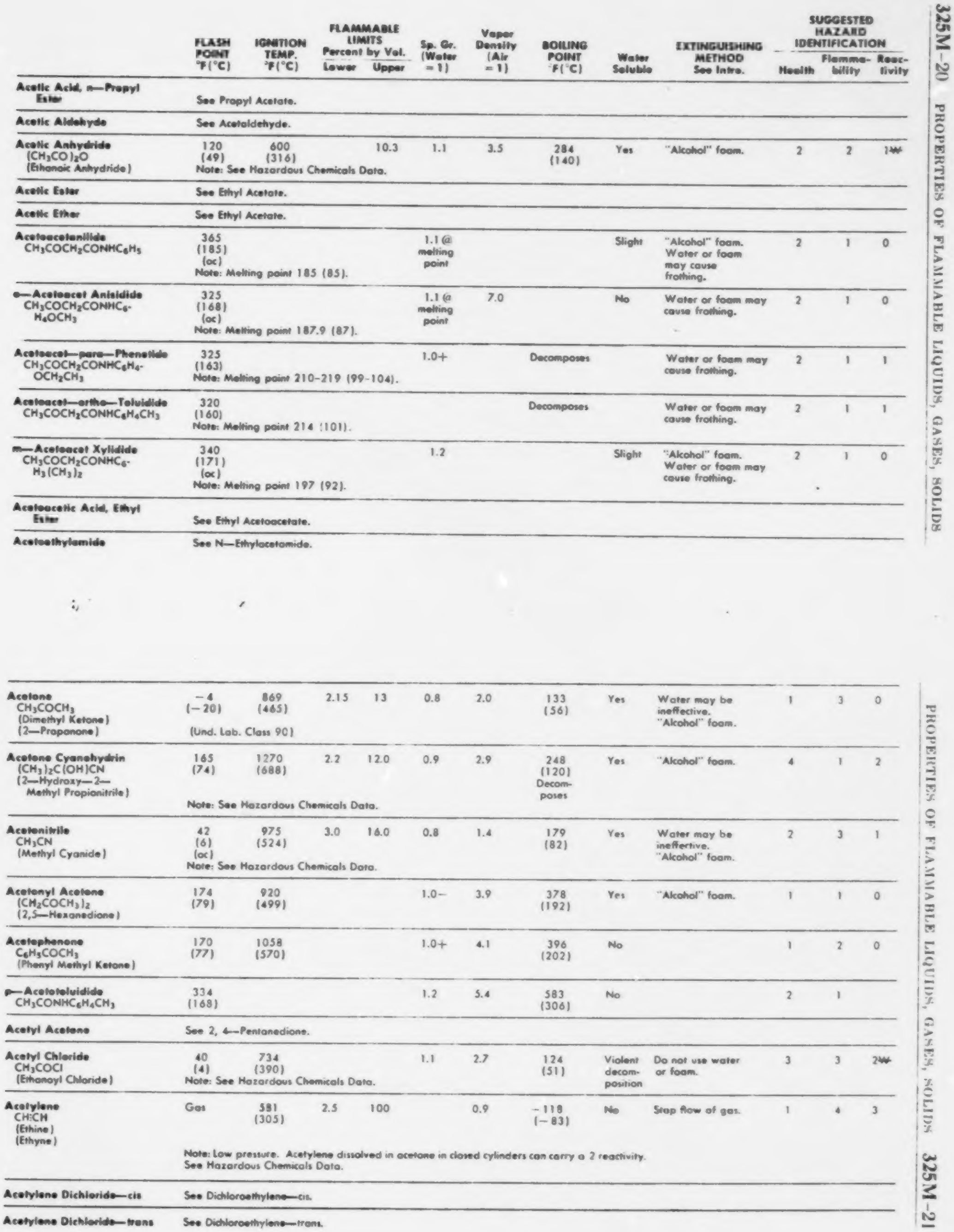
### Ninth Edition

FPI

— A —

| Trade Name | Flash Point | Principal Uses | Manufacturer | Reference |
|---|---|---|---|---|
| A-32 | 185 F | rubber accelerator | Monsanto Co. | Mfr. |
| A-60 | 126 F OC | solvent | Anchor Chemical Co., Inc. | Mfr. |
| A-100 | 175 F | rubber accelerator | Monsanto Co. | Mfr. |
| AB-515 | 235 F OC | detergent intermediate | Conoco Chemicals | Mfr. |
| A-10 Chassis Stencil Ink | 47 F | | | 8 |
| A-11 Chassis Stencil Cleaner | 27 F | | | 8 |
| A.A.I., Animal Area Insecticide | 147 F PMCC | insecticide | Puritan Chemical Co. | Mfr. |
| Abalyn | above 300 F TOC | | Hercules, Inc. | Mfr. |
| ABATE | 140 F OC | fuel oil additive | Penetone Corp. | Mfr. |
| Abate 4-E | 167 F CC | insecticide & larvicide | American Cyanamid Co. | Mfr. |
| Abate 6-E | 109 F CC | insecticide & larvicide | American Cyanamid Co. | Mfr. |
| Abate 200-E | 113 F CC | insecticide & larvicide | American Cyanamid Co. | Mfr. |
| Abate 500-E | 142 F CC | insecticide & larvicide | American Cyanamid Co. | Mfr. |
| Abbott "Leatherneck" Floor Finish | 103 F | floor varnish | Abbott Co. | 4 |
| A. B. D. Solvent No. 7 | 100 F | solvent for brake lining fixture | American Brake Block | 4 |
| A. B. D. Solvent No. 15 | 79 F CC | solvent for brake lining fixture | American Brake Block | 4 |
| A. B. D. Solvent No. 48 | 52 F | solvent for brake lining fixture | American Brake Block | 4 |
| Abitol | above 300 F TOC | | Hercules, Inc. | Mfr. |
| Abitol 90T | 92 F Seta CC | | Hercules, Inc. | Mfr. |
| Abitol 80X | 115 F TCC | | Hercules, Inc. | Mfr. |
| Abitol 90X | 130 F Seta CC | | Hercules, Inc. | Mfr. |
| Absorption Oil | 125 F CC | absorption oil | Texaco Canada Ltd. | Mfr. |
| Acaraben ® 4E | 104 F TCC | insecticide | Ciba-Geigy Corp. Agricultural Div. | Mfr. |
| Accelerator B | 45 F OC | catalyst | Rohm & Haas Co. | Mfr. |
| Accelerator 062 | 138 C CC | accelerator for epoxy resins & anhydride hardener system | Ciba-Geigy Corp. | Mfr. |
| Accelerator 064 | 315 C OC | accelerator for epoxy resins & anhydride hardener system | Ciba-Geigy Corp. | Mfr. |
| Accelerator 065 | 280 C CC | accelerator for cylloaliphatic epoxy/anhydride system | Ciba-Geigy Corp. | Mfr. |

Figure A-29. A typical entry from Section 1: Flash point index of trades names of the Fire Protection Guide On Hazardous Materials (21).

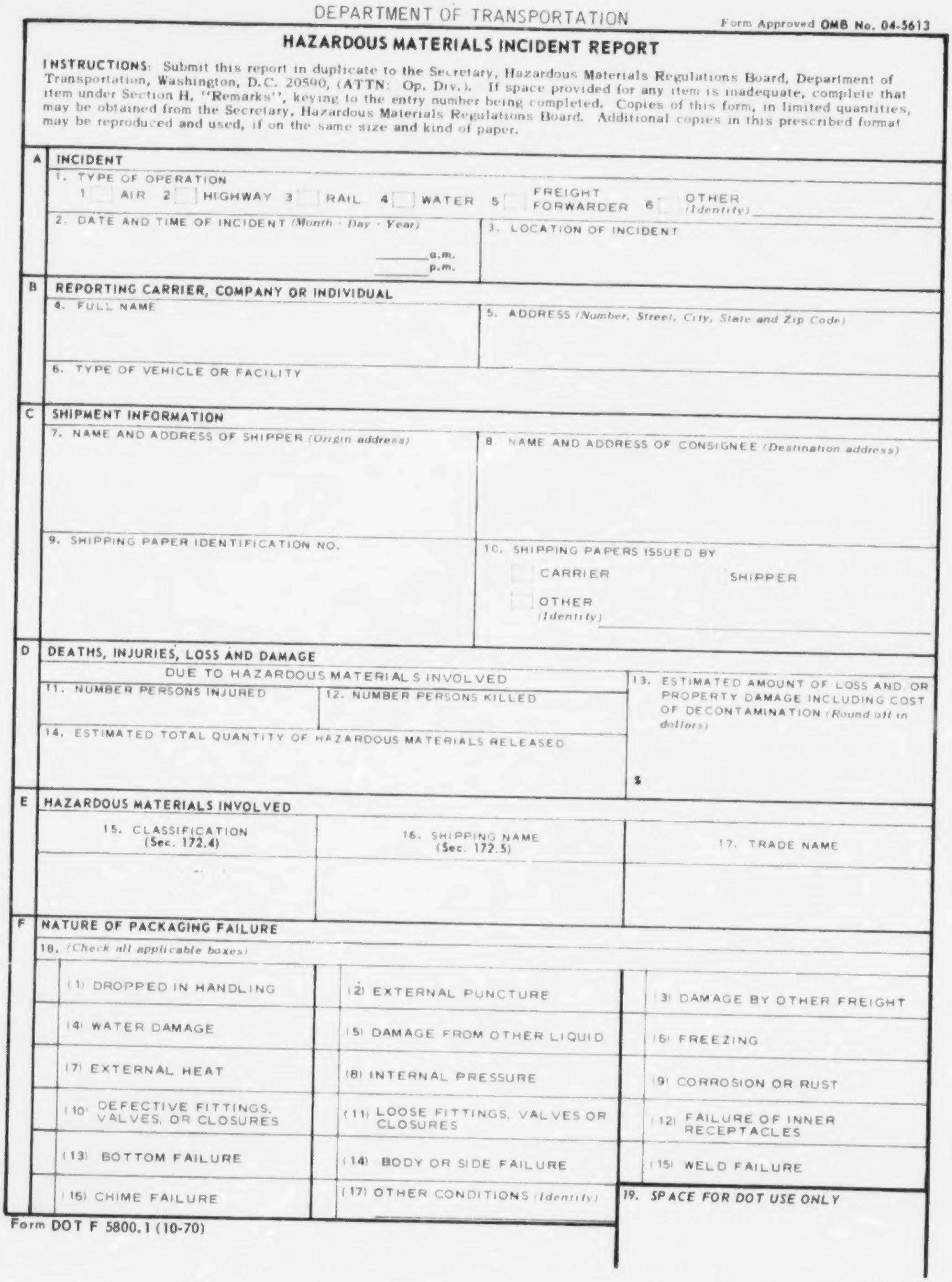


325M–20 PROPERTIES OF FLAMMABLE LIQUIDS, GASES, SOLIDS

| | FLASH POINT °F(°C) | IGNITION TEMP. °F(°C) | FLAMMABLE LIMITS Percent by Vol. | | Sp. Gr. (Water = 1) | Vapor Density (Air = 1) | BOILING POINT °F(°C) | Water Soluble | EXTINGUISHING METHOD See Intro. | SUGGESTED HAZARD IDENTIFICATION | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Lower | Upper | | | | | | Health | Flamma-bility | Reac-tivity |
| **Acetic Acid, n—Propyl Ester** | See Propyl Acetate. | | | | | | | | | | | |
| **Acetic Aldehyde** | See Acetaldehyde. | | | | | | | | | | | |
| **Acetic Anhydride**<br>$(CH_3CO)_2O$<br>(Ethanoic Anhydride) | 120<br>(49)<br>Note: See Hazardous Chemicals Data. | 600<br>(316) | | 10.3 | 1.1 | 3.5 | 284<br>(140) | Yes | "Alcohol" foam. | 2 | 2 | 1~~W~~ |
| **Acetic Ester** | See Ethyl Acetate. | | | | | | | | | | | |
| **Acetic Ether** | See Ethyl Acetate. | | | | | | | | | | | |
| **Acetoacetanilide**<br>$CH_3COCH_2CONHC_6H_5$ | 365<br>(185)<br>(oc)<br>Note: Melting point 185 (85). | | | | 1.1 @ melting point | | | Slight | "Alcohol" foam. Water or foam may cause frothing. | 2 | 1 | 0 |
| **o—Acetoacet Anisidide**<br>$CH_3COCH_2CONHC_6H_4OCH_3$ | 325<br>(168)<br>(oc)<br>Note: Melting point 187.9 (87). | | | | 1.1 @ melting point | 7.0 | | No | Water or foam may cause frothing. | 2 | 1 | 0 |
| **Acetoacet—para—Phenetide**<br>$CH_3COCH_2CONHC_6H_4OCH_2CH_3$ | 325<br>(163)<br>Note: Melting point 210–219 (99–104). | | | | 1.0+ | | Decomposes | | Water or foam may cause frothing. | 2 | 1 | 1 |
| **Acetoacet—ortho—Toluidide**<br>$CH_3COCH_2CONHC_6H_4CH_3$ | 320<br>(160)<br>Note: Melting point 214 (101). | | | | | | Decomposes | | Water or foam may cause frothing. | 2 | 1 | 1 |
| **m—Acetoacet Xylidide**<br>$CH_3COCH_2CONHC_6H_3(CH_3)_2$ | 340<br>(171)<br>(oc)<br>Note: Melting point 197 (92). | | | | 1.2 | | | Slight | "Alcohol" foam. Water or foam may cause frothing. | 2 | 1 | 0 |
| **Acetoacetic Acid, Ethyl Ester** | See Ethyl Acetoacetate. | | | | | | | | | | | |
| **Acetoethylamide** | See N—Ethylacetamide. | | | | | | | | | | | |
| **Acetone**<br>$CH_3COCH_3$<br>(Dimethyl Ketone)<br>(2—Propanone) | −4<br>(−20)<br>(Und. Lab. Class 90) | 869<br>(465) | 2.15 | 13 | 0.8 | 2.0 | 133<br>(56) | Yes | Water may be ineffective. "Alcohol" foam. | 1 | 3 | 0 |
| **Acetone Cyanohydrin**<br>$(CH_3)_2C(OH)CN$<br>(2—Hydroxy—2—Methyl Propionitrile) | 165<br>(74)<br>Note: See Hazardous Chemicals Data. | 1270<br>(688) | 2.2 | 12.0 | 0.9 | 2.9 | 248<br>(120)<br>Decomposes | Yes | "Alcohol" foam. | 4 | 1 | 2 |
| **Acetonitrile**<br>$CH_3CN$<br>(Methyl Cyanide) | 42<br>(6)<br>(oc)<br>Note: See Hazardous Chemicals Data. | 975<br>(524) | 3.0 | 16.0 | 0.8 | 1.4 | 179<br>(82) | Yes | Water may be ineffective. "Alcohol" foam. | 2 | 3 | 1 |
| **Acetonyl Acetone**<br>$(CH_2COCH_3)_2$<br>(2,5—Hexanedione) | 174<br>(79) | 920<br>(499) | | | 1.0− | 3.9 | 378<br>(192) | Yes | "Alcohol" foam. | 1 | 1 | 0 |
| **Acetophenone**<br>$C_6H_5COCH_3$<br>(Phenyl Methyl Ketone) | 170<br>(77) | 1058<br>(570) | | | 1.0+ | 4.1 | 396<br>(202) | No | | 1 | 2 | 0 |
| **p—Acetotoluidide**<br>$CH_3CONHC_6H_4CH_3$ | 334<br>(168) | | | | 1.2 | 5.4 | 583<br>(306) | No | | 2 | 1 | |
| **Acetyl Acetone** | See 2, 4—Pentanedione. | | | | | | | | | | | |
| **Acetyl Chloride**<br>$CH_3COCl$<br>(Ethanoyl Chloride) | 40<br>(4)<br>Note: See Hazardous Chemicals Data. | 734<br>(390) | | | 1.1 | 2.7 | 124<br>(51) | Violent decomposition | Do not use water or foam. | 3 | 3 | 2~~W~~ |
| **Acetylene**<br>CH:CH<br>(Ethine)<br>(Ethyne) | Gas<br>Note: Low pressure. Acetylene dissolved in acetone in closed cylinders can carry a 2 reactivity. See Hazardous Chemicals Data. | 581<br>(305) | 2.5 | 100 | | 0.9 | −118<br>(−83) | No | Stop flow of gas. | 1 | 4 | 3 |
| **Acetylene Dichloride—cis** | See Dichloroethylene—cis. | | | | | | | | | | | |
| **Acetylene Dichloride—trans** | See Dichloroethylene—trans. | | | | | | | | | | | |

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, SOLIDS 325M–21

Figure A-30. A typical entry from Section 2: Fire hazard properties of flammable liquids, gases and volatile solids of the Fire Protection Guide On Hazardous Materials (21).



DEPARTMENT OF TRANSPORTATION

Form Approved **OMB No. 04-5613**

## HAZARDOUS MATERIALS INCIDENT REPORT

**INSTRUCTIONS:** Submit this report in duplicate to the Secretary, Hazardous Materials Regulations Board, Department of Transportation, Washington, D.C. 20590, (ATTN: Op. Div.). If space provided for any item is inadequate, complete that item under Section H, "Remarks", keying to the entry number being completed. Copies of this form, in limited quantities, may be obtained from the Secretary, Hazardous Materials Regulations Board. Additional copies in this prescribed format may be reproduced and used, if on the same size and kind of paper.

**A INCIDENT**

1. TYPE OF OPERATION
1 ☐ AIR 2 ☐ HIGHWAY 3 ☐ RAIL 4 ☐ WATER 5 ☐ FREIGHT FORWARDER 6 ☐ OTHER *(Identify)* ____________

2. DATE AND TIME OF INCIDENT *(Month - Day - Year)*
______ a.m.
______ p.m.

3. LOCATION OF INCIDENT

**B REPORTING CARRIER, COMPANY OR INDIVIDUAL**

4. FULL NAME

5. ADDRESS *(Number, Street, City, State and Zip Code)*

6. TYPE OF VEHICLE OR FACILITY

**C SHIPMENT INFORMATION**

7. NAME AND ADDRESS OF SHIPPER *(Origin address)*

8. NAME AND ADDRESS OF CONSIGNEE *(Destination address)*

9. SHIPPING PAPER IDENTIFICATION NO.

10. SHIPPING PAPERS ISSUED BY
☐ CARRIER ☐ SHIPPER
☐ OTHER *(Identify)* ____________

**D DEATHS, INJURIES, LOSS AND DAMAGE**

DUE TO HAZARDOUS MATERIALS INVOLVED

11. NUMBER PERSONS INJURED

12. NUMBER PERSONS KILLED

13. ESTIMATED AMOUNT OF LOSS AND OR PROPERTY DAMAGE INCLUDING COST OF DECONTAMINATION *(Round off in dollars)*
$

14. ESTIMATED TOTAL QUANTITY OF HAZARDOUS MATERIALS RELEASED

**E HAZARDOUS MATERIALS INVOLVED**

| 15. CLASSIFICATION (Sec. 172.4) | 16. SHIPPING NAME (Sec. 172.5) | 17. TRADE NAME |
|---|---|---|
| | | |

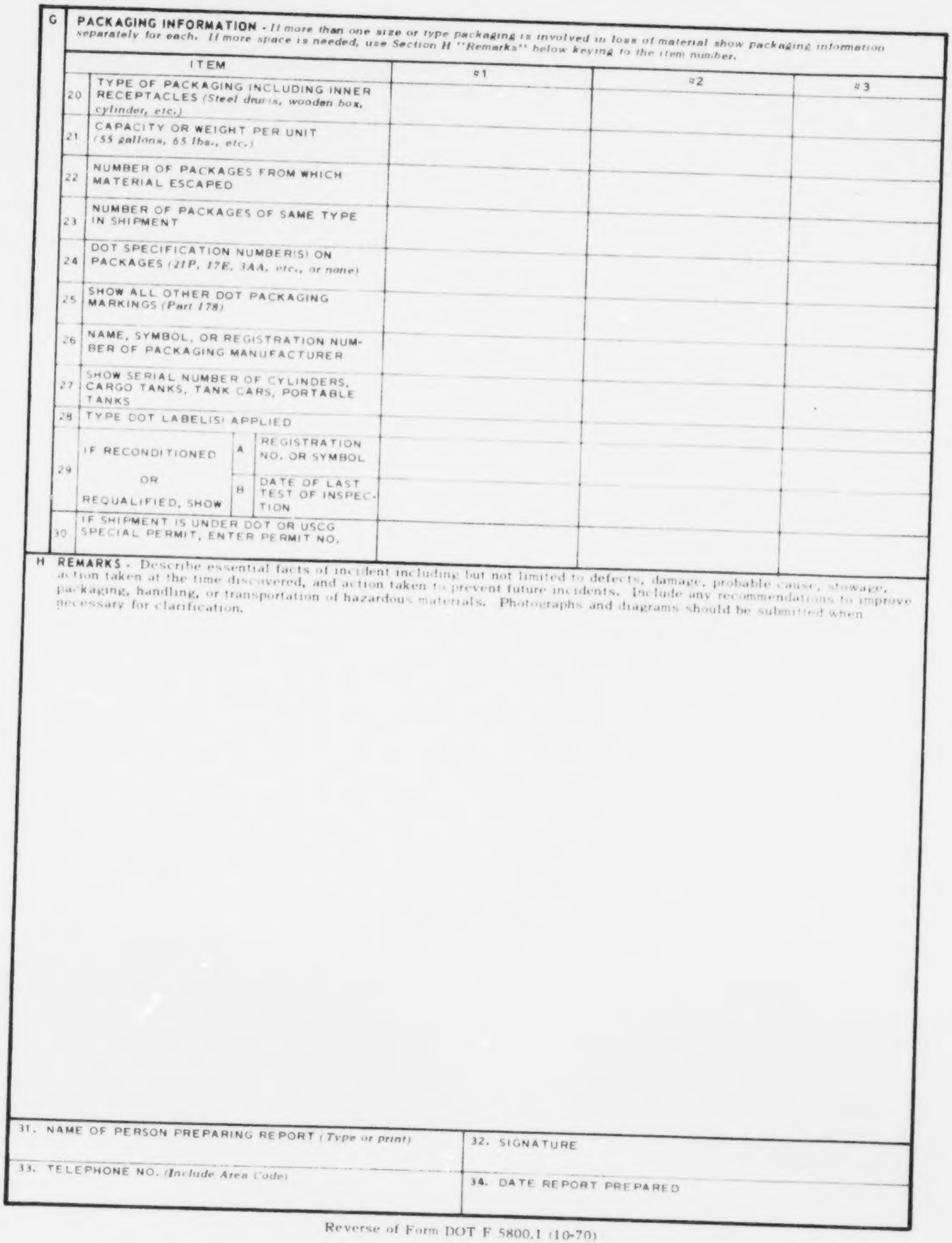
**F NATURE OF PACKAGING FAILURE**

18. *(Check all applicable boxes)*

| | | |
|---|---|---|
| ☐ (1) DROPPED IN HANDLING | ☐ (2) EXTERNAL PUNCTURE | ☐ (3) DAMAGE BY OTHER FREIGHT |
| ☐ (4) WATER DAMAGE | ☐ (5) DAMAGE FROM OTHER LIQUID | ☐ (6) FREEZING |
| ☐ (7) EXTERNAL HEAT | ☐ (8) INTERNAL PRESSURE | ☐ (9) CORROSION OR RUST |
| ☐ (10) DEFECTIVE FITTINGS, VALVES, OR CLOSURES | ☐ (11) LOOSE FITTINGS, VALVES OR CLOSURES | ☐ (12) FAILURE OF INNER RECEPTACLES |
| ☐ (13) BOTTOM FAILURE | ☐ (14) BODY OR SIDE FAILURE | ☐ (15) WELD FAILURE |
| ☐ (16) CHIME FAILURE | ☐ (17) OTHER CONDITIONS *(Identify)* ____________ | **19. SPACE FOR DOT USE ONLY** |

Form **DOT F 5800.1 (10-70)**

Figure A-31. U.S. Department of Transportation Guide for preparing hazardous materials incidents reports.



**G** **PACKAGING INFORMATION** - *If more than one size or type packaging is involved in loss of material show packaging information separately for each. If more space is needed, use Section H "Remarks" below keying to the item number.*

| | ITEM | #1 | #2 | #3 |
|---|---|---|---|---|
| 20 | TYPE OF PACKAGING INCLUDING INNER RECEPTACLES *(Steel drums, wooden box, cylinder, etc.)* | | | |
| 21 | CAPACITY OR WEIGHT PER UNIT *(55 gallons, 65 lbs., etc.)* | | | |
| 22 | NUMBER OF PACKAGES FROM WHICH MATERIAL ESCAPED | | | |
| 23 | NUMBER OF PACKAGES OF SAME TYPE IN SHIPMENT | | | |
| 24 | DOT SPECIFICATION NUMBER(S) ON PACKAGES *(21P, 17E, 3AA, etc., or none)* | | | |
| 25 | SHOW ALL OTHER DOT PACKAGING MARKINGS *(Part 178)* | | | |
| 26 | NAME, SYMBOL, OR REGISTRATION NUMBER OF PACKAGING MANUFACTURER | | | |
| 27 | SHOW SERIAL NUMBER OF CYLINDERS, CARGO TANKS, TANK CARS, PORTABLE TANKS | | | |
| 28 | TYPE DOT LABEL(S) APPLIED | | | |
| 29 | IF RECONDITIONED OR REQUALIFIED, SHOW — A REGISTRATION NO. OR SYMBOL | | | |
| | B DATE OF LAST TEST OF INSPECTION | | | |
| 30 | IF SHIPMENT IS UNDER DOT OR USCG SPECIAL PERMIT, ENTER PERMIT NO. | | | |

**H** **REMARKS** - Describe essential facts of incident including but not limited to defects, damage, probable cause, stowage, action taken at the time discovered, and action taken to prevent future incidents. Include any recommendations to improve packaging, handling, or transportation of hazardous materials. Photographs and diagrams should be submitted when necessary for clarification.

31. NAME OF PERSON PREPARING REPORT *(Type or print)*

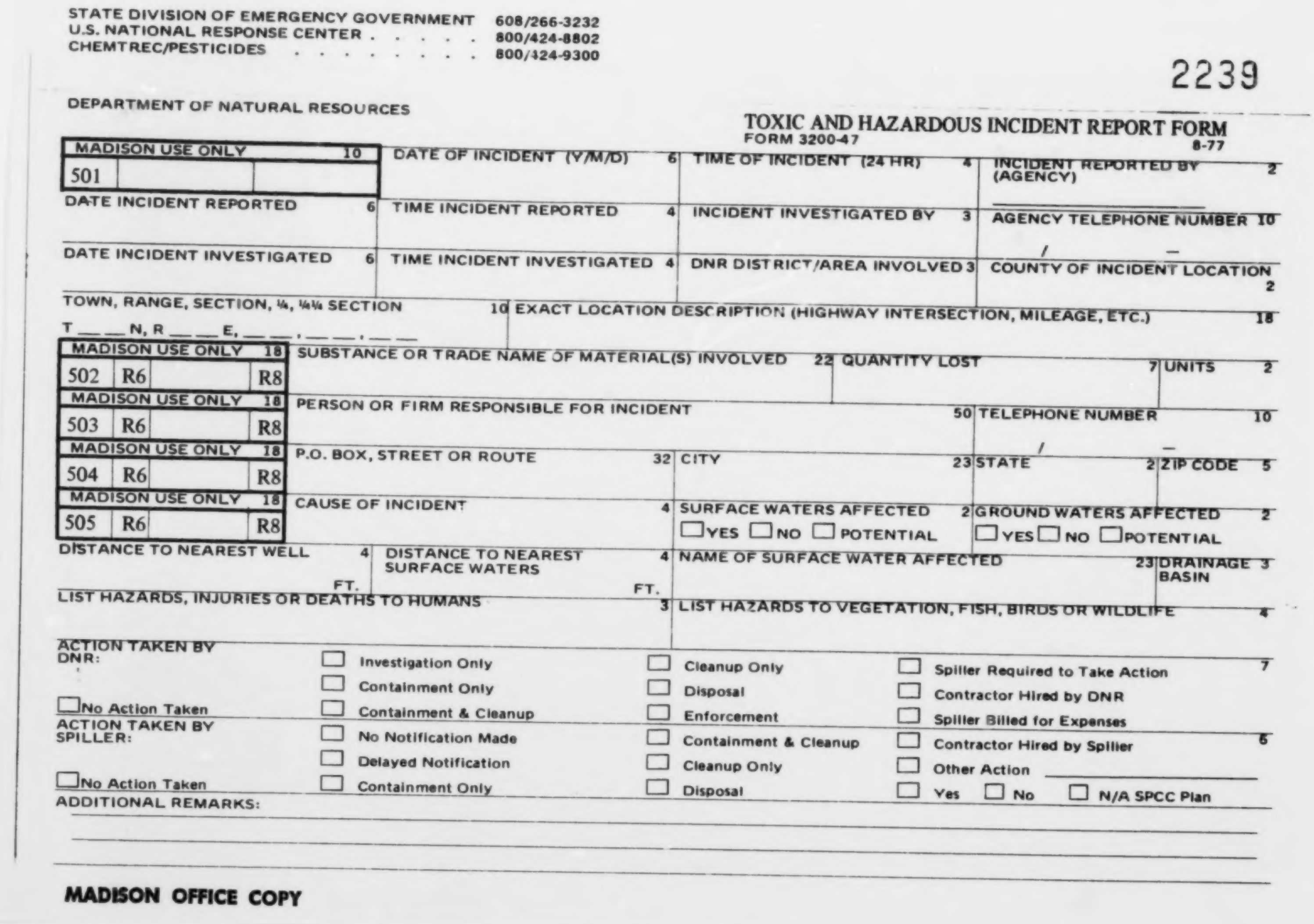
32. SIGNATURE

33. TELEPHONE NO. *(Include Area Code)*

34. DATE REPORT PREPARED

Reverse of Form DOT F 5800.1 (10-70)

Figure A-31. (continued).



STATE DIVISION OF EMERGENCY GOVERNMENT 608/266-3232
U.S. NATIONAL RESPONSE CENTER . . . . . . 800/424-8802
CHEMTREC/PESTICIDES . . . . . . . . . . 800/424-9300

2239

DEPARTMENT OF NATURAL RESOURCES

**TOXIC AND HAZARDOUS INCIDENT REPORT FORM**
FORM 3200-47
8-77

| | | | |
|---|---|---|---|
| MADISON USE ONLY 10<br>501 | DATE OF INCIDENT (Y/M/D) 6 | TIME OF INCIDENT (24 HR) 4 | INCIDENT REPORTED BY (AGENCY) 2 |
| DATE INCIDENT REPORTED 6 | TIME INCIDENT REPORTED 4 | INCIDENT INVESTIGATED BY 3 | AGENCY TELEPHONE NUMBER 10<br>/ – |
| DATE INCIDENT INVESTIGATED 6 | TIME INCIDENT INVESTIGATED 4 | DNR DISTRICT/AREA INVOLVED 3 | COUNTY OF INCIDENT LOCATION 2 |

TOWN, RANGE, SECTION, ¼, ¼¼ SECTION 10
T ___ N, R ___ E, ___, ___, ___

EXACT LOCATION DESCRIPTION (HIGHWAY INTERSECTION, MILEAGE, ETC.) 18

| | | | | |
|---|---|---|---|---|
| MADISON USE ONLY 18<br>502 R6 R8 | SUBSTANCE OR TRADE NAME OF MATERIAL(S) INVOLVED 22 | QUANTITY LOST 7 | UNITS 2 | |
| MADISON USE ONLY 18<br>503 R6 R8 | PERSON OR FIRM RESPONSIBLE FOR INCIDENT 50 | TELEPHONE NUMBER 10<br>/ – | | |
| MADISON USE ONLY 18<br>504 R6 R8 | P.O. BOX, STREET OR ROUTE 32 | CITY 23 | STATE 2 | ZIP CODE 5 |
| MADISON USE ONLY 18<br>505 R6 R8 | CAUSE OF INCIDENT 4 | SURFACE WATERS AFFECTED 2<br>☐ YES ☐ NO ☐ POTENTIAL | GROUND WATERS AFFECTED 2<br>☐ YES ☐ NO ☐ POTENTIAL | |

| | | | |
|---|---|---|---|
| DISTANCE TO NEAREST WELL 4<br>FT. | DISTANCE TO NEAREST SURFACE WATERS 4<br>FT. | NAME OF SURFACE WATER AFFECTED 23 | DRAINAGE BASIN 3 |
| LIST HAZARDS, INJURIES OR DEATHS TO HUMANS 3 | | LIST HAZARDS TO VEGETATION, FISH, BIRDS OR WILDLIFE 4 | |

ACTION TAKEN BY DNR: 7
☐ No Action Taken
☐ Investigation Only
☐ Containment Only
☐ Containment & Cleanup
☐ Cleanup Only
☐ Disposal
☐ Enforcement
☐ Spiller Required to Take Action
☐ Contractor Hired by DNR
☐ Spiller Billed for Expenses

ACTION TAKEN BY SPILLER: 6
☐ No Action Taken
☐ No Notification Made
☐ Delayed Notification
☐ Containment Only
☐ Containment & Cleanup
☐ Cleanup Only
☐ Disposal
☐ Contractor Hired by Spiller
☐ Other Action ________
☐ Yes ☐ No ☐ N/A SPCC Plan

ADDITIONAL REMARKS:

MADISON OFFICE COPY

Figure A-32. State of Wisconsin toxic and hazardous incident report form.

# APPENDIX B - WASTE STREAMS

The general applicability of hazardous spill response manuals to handling hazardous waste streams has been addressed in the body of this report. A more in-depth evaluation has been prepared and the detailed results are presented in this Appendix. The three complete response manuals identified were considered and the chemicals which they addressed were utilized in the review. The three sources were 1) OHM-TADS, (Oil and Hazardous Materials Tehcnical Data Assistance System), 2) CHRIS, (Chemical Hazards Response Information Systems and 3) the EPA Manual for Control of Hazardous Material Spills, Volume 1. The CHRIS review was limited to the approximately 400 chemicals included in the currently available Volume 2 - Hazardous Chemical Data. Additional chemicals have been added to the "CHRIS List". However the data are not published. Therefore, the current manual was the one reviewed.

The results have been presented in two forms. First, a summary table presents the waste streams and a general comment regarding the manuals usefulness in handling the specific hazardous waste constituents (Table B-1). The second table presents the waste stream components and a general rating regarding whether or not they are addressed by the manual. This detailed evaluation allows reference to a specific component of a given waste stream and provides much additional information.

In general, it was difficult to evaluate the manuals' applicability because many of the waste stream constituent identifications were non specific. This was true of categories such as hazardous solvents, toxic pigments, dye stuff, solvents, chlorinated and non-chlorinated materials, chlorinated hydrocarbons, organic chlorides. Other problems were encountered when heavy metals were involved. In these situations, the metal ion was identified but not its corresponding anion. Therefore, it was not possible to determine specifically if the needed information was available. In Table B-2, this situation was addressed by identifying the number of metal salts included in the different manuals. Finally, there were some pure materials which were not addressed in any of the manuals. This fact was noted in the comments.

Another consideration is that the waste streams exist in various forms and their variation in handling techniques due to physical differences is not addressed in the manuals. Also, the impact of mixing different chemicals together has not been considered. Therefore, when mixtures are involved, the proposed treatment processes must be carefully evaluated with regard to potential interferences prior to their applications.

## TABLE B-1. SUMMARY OF RESPONSE MANUAL APPLICABILITY TO HAZARDOUS WASTE STREAMS

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| TEXTILES | 1. Dye and Chemical Containers | Dyestuff; Zinc Compounds | General categories, such as dyestuffs, salts, chlorinated organics, flammables, or sludges containing chlorinated hydrocarbons, are not specific enough to be addressed in any manual. Metal compounds are addressed mostly in OHM-TADS and the EPA manuals, although specific compounds may or may not be included. Diphenyl ether is not considered in any manual. Both aluminum and copper chlorides are not universally covered. Pure metals may or may not be considered. |
| | 2. Waste Water Treatment Sludges | Dyestuff; Chlorinated Organics;<br>Compounds of: Arsenic; Barium; Cadmium; Chromium; Copper; Iron; Lead; Magnesium; Manganese; Mercury; Zinc | |
| | 3. Solvents and Solvent Recovery Still Bottoms | Flammables | |
| | 4. Waste Scavenging Catalyst | Copper Chlorides; Diphenyl Ether; Organics | |
| | 5. Refinery Waters | Lead; Aluminum Chloride; Hydrochloric Acid; Salts | |
| | 6. Chlorinated Solvent Reclaiming Operations | Sludge containing Chlorinated Hydrocarbons | |
| PLASTIC MATERIALS & SYNTHETICS | 7. Phenolic Resin Production Wastes | Phenols | General categories including various organic solvents, polymer solids, cuprammonium wastes, phenols, solvents, and heavy metals are not specific enough to be addressed in any manual. The selenium and manganese compounds were not addressed in all three manuals. For the specific chemicals included in this category, OHM-TADS had information most consistently on all compounds. Dithiocarbamate, aliphatic mercury compounds, aromatic mercury compounds, selenates, methyl mercuric chlo- |
| | 8. Amino Resin Production Wastes | Formaldehyde | |
| | 9. Polyester Production Catalyst Waste | Antimony; Cadmium; Manganese | |
| | 10. Still Bottom Wastes from Solvent or Monomer Tanks | Solvents | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PLASTIC MATERIALS & SYNTHETICS (cont. from previous page) | 11. Waste Solvents from Silicone Resin Production | Solvents | ride, and mercury chlorides were not included in any of the manuals. Ethyl cellosolve is not a common chemical term and was not addressed. Except for antimony pentaflouride, the other pure chemical waste stream components were considered in two or three of the manuals reviewed. |
| | 12. Wastes from Dust Control Equipment | Dithiocarbamate; Ethylenediamine | |
| | 13. Wastewater Treatment Sludges | Heavy Metals | |
| | 14. Residuals from Manufacturing of Ethylene Dichloride, Vinyl Chloride | Solvents; Chlorinated and Non-Chlorinated Materials (Allyl Chloride; Methyl Mercuric Chloride) | |
| | 15. Urethane Manufacturing Wastes | Mercury; Aliphatic Mercury Compounds; Aromatic Mercury Compounds | |
| | 16. Synthetic Rubber Industry Wastes | Nitrobenzene; Antimony Pentafluoride | |
| | 17. Pigment Wastes | Cadmium; Selenates; Selenium | |
| | 18. Cellulose Ester Production Wastes | Acetic Acid; Sulfuric Acid; Mercury Chlorides; Methyl Methacrylate; Ethyl Cellosolve | |
| | 19. Vinyl Resins Manufacturing Wastes | Phenols; Carbon Tetrachloride; Chloroform | |
| | 20. Rayon Fiber Production Wastes | Zinc Chloride; Cuprammonium Wastes; Copper; Sulfuric Acid; Ammonia | |
| | 21. Other Synthetic Polymer Wastes | Adiponitrile; Polymer Solids; Various Organic Solvents; Hydrogen Cyanide; Phosgene; Toluene Disocyanate; Toluene | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PHARMACEUTICALS | 22. Wastes from Organic Medicinal Chemical Manufacturing | a. Heavy Metals: Copper; Mercury; Arsenic; Zinc; Chromium; Selenium<br>b. Halogenated Waste Solvents: Ethylene Dichloride; Methylene Chloride<br>c. Non-Halogenated Waste Solvents: Acetone; Methanol; Isopropyl Alcohol; Toluene; Benzene; Acetonitrile; Xylene<br>d. Non-Halogenated Wastes from Manufacturing of Antibiotics: Amyl Acetate; Butanol; Butyl Acetate; Methylisobutyl Ketone; Acetate; Ethylene Glycol Monomethyl Ether<br>e. Non-Halogenated Wastes from Manufacturing of Botanicals: Methanol; Acetone; Ethanol; Chloroform; Heptane; Naptha; Benzene<br>f. Non-Halogenated Wastes from Manufacturing of Medicine from Animal Glands: Ethanol; Methanol; Acetone<br>g. Organic Chemical and Biological Residues:<br>Terpenes; Steroids: Vitamins; Tranquilizers<br>Aqueous Ethanol; Antiviral Vaccine; Toxoids; Serium; Various Contaminated | The pharmaceutical industry waste stream is not covered to an extensive degree by OHM-TADS, CHRIS or the EPA manual. OHM-TADS lists heavy metals, halogenated waste solvents, and non-halogenated waste solvents. Non-halogenated wastes from the manufacturing of antibiotics are not consistently listed in any of the manuals. OHM-TADS covered non-halogenated wastes from botanicals and medicine manufactured from animal glands. Organic chemical and biological residues along with arsenic wastes are not covered specifically by any of the manuals. OHM-TADS covers most general organic chemical wastes. Heavy metals include copper, mercury, arsenic, zinc, chromium, and selenium. Some of their salts are addressed in all manuals. Halogenated waste solvents include ethylene dichloride, methylene chloride and are covered in OHM-TADS. Methylene dichloride, monomethyl ether, terpenes, steroids, vitamins, tranquilizers, serium, arsenylic acids, antiviral vaccine, toxoids, aliphatic mercury compounds, aromatic mercury compounds, organic arsenites, fluorobenzoic, activated carbon, tetrachlorethane, benzo trifluoride, and diphenylamine wastes are not listed by any ot eh three manuals. |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PHARMACEUTICALS (cont. from previous page) | 23. Mercurial Wastes | Mercury; Aliphatic Mercury Compounds; Aromatic Mercury Compounds | |
| | 24. Nitrite containing Wastes | Phosgene | |
| | 25. Pharmaceutical Arsenic Waste | Inorganic Arsenites; Organic Arsenites; Arsenylic Acid; Sodium Chloride | |
| | 26. Organic Chemical Wastes | Dimethyl Foramide; Methylethyl Ketone; Acetonitrile; Caustic; Benzylchloride; Flurobenzoic Acid; Dichlorobenzene; Trichlorobenzene; Activated Carbon; Chlorobenzene; Toluene; Methanol; Methylene Dichloride; Pyridine; Tetrachloroethane; Trichloroethylene; Benzo-Trifluoride; Chlorosulfonic Acid; Diphenylamine Wastes | |
| INORGANIC CHEMICALS | 27. Diaphragm Cell Process: Sludges from Brine Treatment and Waste Separation in the production of Alkalies and Chlorine | Lead; Asbestos; Chlorinated Hydrocarbons | Inorganic chemicals cover a large variety of hazardous compounds. Categories too general to be covered by any manual include chlorinated hydrocarbons, phosphates, phenols, and organic chlorides. All metals have at least one compound listed in every manual. OHM-TADS and EPA have the most complete list of heavy metal compounds. Pure metals may or may not be considered. Asbestos, aliphatic organomercury, nickel carbonyl, chlorine trifluorine, chlorine pentafluoride, bromine pentafluoride, silicon terrafluoride, carbon tetrafluoride, carbon dioxide, barium sulfide, tar, tetranitromethane, diphenylamine, amyl |
| | 28. Mercury Cell Process: Sludges, Muds and Filter Cakes from Brine Purification, Process Waste Treatment and Cell Room Cleanup in the production of Alkalies and Chlorine | Mercury; Chlorinated Hydrocarbons | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| INORGANIC CHEMICALS (cont. from previous page) | 29. Filter Cakes and Sludges from Wastewater Treatment in the production of Chrome Colors and Other Pigments | Chromium; Cadmium; Cyanide; Lead; Zinc | amine, meta-nitrochlorobenzene, para-nitrochlorobenzene, hydrogen bromide, ammonium silicofluoride, fluoracetic acid, lead carbonate, ammonium fluoride, ammonium bifluoride, potassium fluoride, potassium bifluoride, sodium bifluoride, trichloromeltrane, and trichloromeltrene are not included in any manual. |
| | 30. Wastewater Treatment Sludge in the production of Hydrofluoric Acid | Fluoride | |
| | 31. Wastewater Treatment Sludge in the production of Sodium Silicofluoride | Fluoride | |
| | 32. Waste Treatment Muds and Sludges in the production of Chromates | Chromium | |
| | 33. Waste Treatment Sludges in the production of Phosphorus | Phosphorus; Phosphates; Arsenic | |
| | 34. Chlorine Production Brine Sludges | Mercury Salts; Aliphatic Organomercury; Calcium Oxide; Asbestos; Lead; Chlorinated Hydrocarbons; Sulfuric Acid | |
| | 35. Inorganic Chemicals | Diborane; Pentaborane-9; Decaborane | |
| | 36. Nickel Carbonyl Production Wastes | Nickel Carbonyl | |
| | 37. Waste Chlorine Trifluoride | Chlorine; Trifluorine | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| INORGANIC CHEMICALS (cont. from previous page) | 38. Waste Chlorine Pentafluoride | Chlorine Pentafluoride | |
| | 39. Waste Bromine Pentafluoride | Bromine Pentafluoride | |
| | 40. Arsenic Production Wastes | Arsenates | |
| | 41. Co-Synthesis Methanol Production Wastes | Organic Chloride; Chromic Sulfate; Zinc Chloride | |
| | 42. Contaminated Fluorine | Silicon Terrafluoride; Carbon Tetrafluoride; Hydrogen Fluoride; Carbon Dioxide; Fluorine | |
| | 43. Sodium Dichromate Production Wastes | Chromium Salts; Sodium Sulfate | |
| | 44. Waste from production of Barium Compounds | Barium Carbonate; Barium Chloride; Barium Cyanide; Barium Nitrate; Barium Sulfide | |
| | 45. Waste or Contaminated Perchloric Acid | Perchloric Acid | |
| | 46. Wastes from production of Mercuric Cyanide | Mercuric Cyanide | |
| | 47. Contaminated Antimony Pentafluoride | Antimony Pentafluoride | |
| | 48. Fluorine Production | Hydrogen Fluoride; Fluorine | |
| | 49. Ethylene via Thermal Pyrolysis | Phenols; Organic Chlorides | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| INORGANIC CHEMICALS (cont. from previous page) | 50. Cumene Oxidation Process Phenol Production Wastes | Dichlorobenzene; Trichlorobenzene; Tar | |
| | 51. Contaminated Tetranitromethane | Tetranitromethane | |
| | 52. Diphenylamine Wastes - Pharamaceutical Industries | Diphenylamine | |
| | 53. Liquid (off-spec) Toluene Di-isocyanate | Toluene Di-isocyanate | |
| | 54. Off-grade Maleic Anhydride | Maleic Anhydride | |
| | 55. Off-spec or Waste Phenol | Phenol | |
| | 56. Organic Liquid Contaminated Nitrobenzene | Nitrobenzene; Aniline; Chlorobenzene; Substituted Amyl Amine | |
| | 57. Solid Off-Spec or Overage Dinitrophenol | Dinitrophenol | |
| | 58. Still Bottoms from Maleic Anhydride Manufacturers | Maleic Acid; Tars; Maleic Anhydride | |
| | 59. Wastes from production of Nitrochlorobenzene | Meta-Nitrochlorobenzene | |
| | 60. Waste Stream from Wastewater treatment | Meta-Nitrochlorobenzene; Para-Nitrochiorobenzene | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| INORGANIC CHEMICALS (cont. from previous page) | 61. Hydrogen Bromide Wastes | Hydrogen Bromide | |
| | 62. Waste from Hydrogen Cyanide Production | Hydrogen Cyanide | |
| | 63. Manufacturing Wastes from Ammonium Silicofluoride | Ammonium Silicofluoride; Fluoracetic Acid | |
| | 64. From the manufacture of Lead Nitrate, Acetate and Carbonate | Lead Carbonate; Lead Acetate; Lead Nitrate | |
| | 65. From the manufacture of Sodium Azide | Sodium Azide | |
| | 66. Production Wastes Phosphorous | White or Yellow Phosphorous 309; Sodium Phosphate 371; Sodium Fluoride 359 | |
| | 67. Wastes from Fluoride Salt Production | Ammonium Fluoride; Ammonium Bifluoride; Potassium Fluoride; Potassium Bifluoride; Sodium Fluoride; Sodium Bifluoride; Hydrofluoric Acid | |
| | 68. N-Butane Dehydrogenation Burtadiene Production Wastes | Chromic Sulfate; Organic Chloride; Sodium Sulfides 372 | |
| | 69. Formaldehyde Production Wastes | Chromic Sulfate; Carbon Tetrachloride; Chloroform; Trichloro-meltrane; Trichloromeltrene | |
| | 70. Cyanide Production Wastes | Sodium Cyanate; Sodium Cyanide; Sodium Hypochlorite | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| INORGANIC CHEMICALS (cont. from previous page) | 71. Potassium Chromate Production Waste | Potassium Chromate; Potassium Dichromate | |
| PRIMARY METALS | 72. Slurries and Sludges from Primary Smelting and Electrolytic Refining of Copper | Chromium; Copper; Cadmium; Mercury; Manganese; Nickel; Lead; Antimony; Selenium; Zinc | OHM-TADS lists most heavy metals and some of their compounds, while CHRIS mentions a single metal compound, and the EPA manual is not specific to heavy metal elements. Oil and grease, acid, and chlorinated hydrocarbons are not specific enough to be covered in any manual. Chrome, nickel carbonyl, thallium sulfate, hypochbridic acid, car acids, thiocyanate, thiosulfate, bright dip liquor, most berryllium compounds, zinc plating, lead carbonate, isobutyl ketone, and bichromate are not referred to in any manual. |
| | 73. Digestion Residue (Filter Cake) from primary refining of Tungsten | Copper; Lead; Zinc | |
| | 74. Wastewater Treatment (filtration) Sludge in the primary refining of Tungsten | Copper; Arsenic; Lead; Zinc | |
| | 75. Blast Furnace Slag from the pyrometallurgical process in the secondary smelting and refining of copper | Copper Manganese; Nickel; Lead; Antimony; Zinc | |
| | 76. Lime-treated Sludge, Wastewater from emissions scrubber in the secondary smelting and refining of Aluminum | Copper; Lead; Zinc | |
| | 77. Coke and By-product plants: Waste ammonia liquor; wastewater treatment lime sludge in the smelting and refining of ferrous metals | Phenol; Cyanide | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PRIMARY METALS (cont. from previous page) | 78. Decanter Tank Tar in the smelting and refining of ferrous metals | Phenol; Oil and Grease | |
| | 79. Electric Furnaces: Dust from dry emissions control in the smelting and refining of ferrous metals | Lead | |
| | 80. Sludge from wet emissions control in the smelting and refining of ferrous metals | Chromium, Lead | |
| | 81. Process and wastewater treatment sludges from mills (primary, continuous casting, hot rolling, tin plating, galvanizing) | Chromium; Copper Manganese; Nickel; Lead; Zinc; Oil and Grease | |
| | 82. Mill scale from primary, continuous casting, hot rolling, cold rolling mills in the smelting and refining of ferrous metals | | |
| | 83. Pickle liquors from cold rolling and galvanizing mills in the smelting and refining of ferrous metals | Acid; Chromium; Copper; Manganese; Nickel; Lead; Zinc | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PRIMARY METALS (cont. from previous page) | 84. Dust and sludges from air pollution control in the primary smelting and refining of ferromanganese and silicomanganese alloys | Zinc; Lead | |
| | 85. Dust and sludges from air pollution control in the manufacture of ferrochrome | Chrome; Lead | |
| | 86. Tailings from skull plant in the manufacture of ferronickel | Copper; Zinc | |
| | 87. Mercury Ore Extraction Wastes | Mercury | |
| | 88. Nickel Carbonyl Production Wastes | Nickel Carbonyl | |
| | 89. Old or Contaminated Thallium Sulfate or Rodenticide | Thallium; Thallium Sulfate | |
| | 90. Consolidated Steel Wastes Sludge | Phenols; Sodium Cyanide; Sodium Fluorides; Ammonia; Sulfuric Acid; Chromic Sulfate; Zinc Chloride; Hydrochloridic Acid | |
| | 91. Iron Manufacturing Wastes; Sludge | Phenol; Ammonia; Sodium Cyanide | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PRIMARY METALS (cont. from previous page) | 92. Coke plant raw waste sludge | Phenol; Sodium Cyanide; Ammonia 19; Tar Acids; Thiocyanate; Thiosulfate; Nitrogen Bases as Pyridine; Hydrogen Cyanide | |
| | 93. Stainless steel pickling liquor | Hydrofluoric Acid; Sulfuric Acid; Iron; Chromium; Nickel; Cobalt; Nitric Acid | |
| | 94. Brass mill wastes | Copper Sulfate; Zinc; Sodium Dichromate Sulfuric Acid; Bright Dip Liquor | |
| | 95. Arsenic Trioxide from smelting industry wastes | Arsenic Trioxide; Selenium; Sulfuric Acid; Hydrochloric Acid; Copper; Lead; Mercury; Antimony | |
| | 96. Selenium production wastes (particulates) | Selenium | |
| | 97. Thallium production wastes | Thallium | |
| | 98. Beryllium production wastes | Beryllium Powder; Beryllium Carbonate; Beryllium Chloride; Beryllium Hydroxide Beryllium Oxide; Beryllium Selenate | |
| | 99. Zinc plating wastes | Zinc plating; zinc cyanide; sodium hydroxide; Hydrogen Cyanide | |
| | 100. Waste Scavenging Catalyst | Copper Chlorides; Organics (Diphenyl Ether) | |
| | 101. From Laboratories and Plants using Lead | Lead Carbonate; Lead Acetate; Lead Nitrate | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PRIMARY METALS (cont. from previous page) | 102. Refinery Waters | Lead; Aluminum Chloride; Hydrochloric Acid | |
| | 103. Refinery Brines | Lead; Other Salts | |
| | 104. Wastes from Chlorinated Solvent Reclaiming Operations | Sludge containing Chlorinated Hydrocarbons | |
| | 105. Nickel Ore Extraction | Nickel Sulfate; Sulfuric Acid; Isobutyl Ketone; Hydrofluoric Acid | |
| | 106. Tube Manufacturing Manganese Wastes | Sodium Hydroxide; Potassium Permanganate; Iron; Copper | |
| | 107. Metal Finishing Pickle Liquor | Sulfuric Acid; Hydrochloric Acid | |
| | 108. Wire Drawing Waste | Copper; Alkaline Wetting Oils | |
| | 109. Copper Tube Extruding Waste | Copper; Nickel; Hydrofluoric Acid; Nitric Acid | |
| | 110. Antimony and Antimony Trioxide Waste from smelting industry | Antimony; Antimony Trioxide; Antimony Pentoxide | |
| | 111. Nickel Alloy Manufacturing Sludges | Nickel Sulfate; Copper Sulfate; Sodium Fluoride; Sodium Hydroxide | |
| | 112. Aluminum and Copper Rolling Mill | Copper; Chromium; Aluminum; Sulfuric Acid; Bichromate | |
| | 113. Cold Finishing Wastes | Cyanide; Ferrous Sulfate; Sodium Chromate; Zinc Chloride; Chlorinated Solvents | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PESTICIDES AND EXPLOSIVES (Organic Chemicals) | 114. Cadmium-Selenium Pigment Wastes | Cadmium; Selenium; Selenates | Pesticides, herbicides, high explosive contaminated wastes, and wastes from propellant manufacturers are not adequately covered by any of the manuals. Dye manufacturing wastes are best covered by OHM-TADS but are included in CHRIS and EPA to some extent. Selanates, water, disulfonic acid, chromic hydroxide sludge, diphenylamine, manganese thiocarbonate, buxten, carbofuran, 2, 6-D, monophenoxy, trichlorophenoxy, alpha methyl styrene, TNT, HMX, TDX, PETN, TETRYL, RDX, PNC, nitrocellulose, smokeless powder, lead chromate, tetranitro methane, sodium nitrate, nitrotoluene, dinitrotoluene, lead azide dextrinated, lead styphanate, mannitol hexanitrate, mercury fulminate, and dinitro benzene furoxam are not included in any manual. Chromates are listed in the EPA manual but are not specific enough for the other manuals. Sulfides, powdered metals and nitro-phenols are too general to be addressed by any manual. |
| | 115. Spent Wood Preserving Liquid | Pentachlorophenol; water | |
| | 116. Wastes from Dye Manufacturing | Copper; Chromium; Phenols; Hydrogen; Cyanide; Amiline; Disulfonic Acid | |
| | 117. Chromates Wastes from Pigments and | Chromates ($Cr^{+3}$); Chromic Hydroxide Sludge; Sulfides; Diphenylamine; | |
| | 118. Wastes from the manufacture of Chloropicrin | Chloropicrin | |
| | 119. Wastes from the manufacture of Tetraethyl - and Tetramethyl Lead | Tetraethyl Lead; Tetramethyl Lead | |
| | 120. Wastes from Carbonated Pesticide Manufacturing and certain DOD activities | Manganese Thiocarbonate; Zinc; Bux Ten; Carbaryl; Carbofuran | |
| | 121. Wastes from Production of Phenoxy Herbicides | 2,4-D; 2,6-D; Mono & Trichloro Phenoxy; Acetic Acids; 2,4,5-T | |
| | 122. Contaminated Antimony Trifluoride | Antimony Trifluoride | |
| | 123. Contaminated Antimony Pentafluoride | Antimony Pentafluoride | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PESTICIDES AND EXPLOSIVES (Organic Chemicals) | 124. Contaminated PCB | Polychlorinated Biphenols; Alpha Methyl Styrene | |
| | 125. High Explosive Contaminated Solid Wastes | TNT; HMX; TDX; PETN; TETRYL; TDX | |
| | 126. Wastes from Solid Propellant Manufacturing, Propellant Contaminated Waste, Industrial Propellant Explosive Waste | Jeletinized (PNC); Nitro Cellulose; Smokeless Powder; Single Base; Multiple Base | |
| | 127. Wastes from Manufacture | Lead Carbonate; Lead Acetate; | |
| | 128. Jet and Rocket Fuel Storage and Use Wastes | Hydrazine | |
| | 129. Waste Pyrotechnics and Incindiaries | Powdered Metals; Phosphorous; Tungsten; Potassium Perchlorate; Barium Chromate; Lead Chromate | |
| | 130. Pyrotechnic and Incindiary Contaminated Wastes | Phosphorous; Tungsten | |
| | 131. Contaminated Tetranitromethane | Tetranitromethane | |
| | 132. TNT - Red Water Waste | Sodium Sulfite; Sodium Nitrite; Sodium Nitrate; Nitrotoluene; Dinitrotoluent; Trinitrotoluene; Acetic Acid | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PESTICIDES AND EXPLOSIVES (Organic Chemicals) | 133. Contaminated Wastes from Manufacture of Primary Explosives | Lead Azide Dextrinated; Lead Styphanate; Mannitol Hexanitrate; Mercury Fulminate; Potassium Dinitro Benzene Furoxam; Nitro-Phenols | |
| PAINT AND ALLIED PRODUCTS | 134. Cleanings and Wastewater Treatment Sludges from the Production of Solvent-thinned Trade Sales Paints | Hazardous Solvents* and Toxic Pigments | Hazardous components contain lead compounds, chromium, cadmium, selenium, cyanides, mercury, hazardous solvents and toxic pigments. Typical hazardous solvents are: acetone, n-butyl acetate, ethanol, diacetone alcohol, ethyl acetate, heptane, hexane, isopropanol, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), methanol, mineral spirits, toluene, VM and P naphtha, and xylene. Hazardous solvents are too general to be listed specifically in any of the manuals. Lead carbonate, lead oxide, cleaners, resins, selenates, and mineral spirits are not listed in any of the manuals. Heavy metals are covered the most completely by OHM-TADS. Both OHM-TADS and CHRIS list the majority of the hazardous solvents and toxic pigments. Some naptha are included in CHRIS but VM naptha and P naptha are not listed explicitly. |
| | 135. Raw materials bags and packages from the production of solvent-thinned trade sales | Hazardous Solvents* and Toxic Pigments | |
| | 136. Cleanings and wastewater treatment sludges from the production of water-thinned trade sales paints | Toxic Pigments | |
| | 137. Raw materials bags and packages from the production of water-thinned trade sales paints | Toxic Pigments | |
| | 138. Cleaning and wastewater treatment sludges from the production of lacquers | Hazardous Solvents* | |
| | 139. Raw materials bags and packages from the production of lacquers | Hazardous Solvents* | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PAINT AND ALLIED PRODUCTS (cont. from previous page) | 140. Cleanings and wastewater treatment sludges from the production of factory-applied coatings | Hazardous Solvents* and Toxic Pigments | |
| | 141. Raw materials bags and packages from the production of factory-applied coatings | Hazardous Solvents* and Toxic Pigments | |
| | 142. Air pollution control residues from the production of factory-applied coatings | Hazardous Solvents* and Toxic Pigments | |
| | 143. Spoiled batches from the production of factory-applied coatings | Hazardous Solvents* and Toxic Pigments | |
| | 144. Spills from the production of factory-applied coatings | Hazardous Solvents* and Toxic Pigments | |
| | 145. Cleanings and wastewater treatment sludges from the production of putty and miscellaneous paint products | Hazardous Solvents* and Toxic Pigments | |
| | 146. Raw materials bags and packages from the production of putty and miscellaneous paint products | Hazardous Solvents* and Toxic Pigments | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PAINT AND ALLIED PRODUCTS (cont. from previous page) | 147. Air pollution control residues from the production of putty and miscellaneous paint products | Hazardous Solvents* and Toxic Pigments | |
| | 148. Spoiled batches from the production of putty and miscellaneous paint products | Hazardous Solvents* and Toxic Pigments | |
| | 149. Spills from the production of putty and miscellaneous paint products | Hazardous Solvents* and Toxic Pigments | |
| | 150. Paint Manufacture Sludge | Lead Carbonate; Lead Oxide; Cleaners; Resins | |
| | 151. Solvent-Based Paint Sludge | Lead; Chromium; Cadmium; Selenium; Cyanides | |
| | 152. Water-Based Paint Sludge | Chromium; Mercury | |
| | 153. Cadmium-Selenium Pigment Wastes | Cadmium; Selenium; Selenates | |
| | 154. Typical Hazardous Solvents are: | Acetone; N-Butyl Acetate; Ethanol; Diacetone Alcohol; Ethyl Acetate; Heptane; Hexane; Isopropanol; MEK; MIBK; Methanol; Mineral Spirits; Toluene; VM & P Naphtha; Xylene | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| STORAGE AND PRIMARY BATTERIES | 155. Wastewater Treatment Sludges in the manufacture of lead-acid storage batteries | Lead; Lead Compounds | An adequate listing of hazardous materials generated by the manufacture of batteries is not offered by any of the manuals. OHM-TADS does have thorough coverage of heavy metals, but it does not cover heavy metal compounds produced during the manufacture of storage and primary batteries. Cadmium carbonate, hydroxide, nickel carbonate, copper hydroxide, cadmium oxide, and nickelic oxide are not included in any manual. |
| | 156. Rejected and scrap carbon-zinc primary batteries | Mercury; Zinc | |
| | 157. Rejected and scrap carbon-zinc air cells batteries | Mercury; Zinc | |
| | 158. Battery Manufacture Sludges (40% solids) | Cadmium Carbonate; Hydroxide; Nickel Carbonate; Copper Hydroxide; Lead Sulfate; Arsenic; Antimony | |
| | 159. Battery Manufacture | Cadmium Oxide; Nickelic Oxide; | |
| | 160. Mercury Cell Battery Wastes | Mercury | |
| ELECTRONIC COMPONENTS MANUFACTURING | 161. Electronic Circuitry Manufacturing Wastes | Potassium Ferrocyanide; Sodium Hydroxide; Lead; Nickel; Chromium Copper; Hydrochloric Acid; Sulfuric Acid; Hydrocyanic Acid; Carbon Tetrachloride; Chloroform | The most complete listing of pollutants generated by the manufacture of electronic components is found in OHM-TADS. General categories, such as dirt, organics, mixed solvents, sludges, oils, and heavy metals, are not specific enough to be addressed by any manual. Cupric hydroxide, nicklic hydroxide, chromic oxide, freon, and photoresist are not covered by any manual. |
| | 162. Electronic Tube Production Wastes | Cupric Hydroxide; Calcium Phosphate; Nicklic Hydroxide; Mercury; Barium Compounds; Hydrogen Fluoride. | |
| | 163. Magnetic Tape Productions | Ammonium Dichromate; Dirt and Organics; Chromic Oxide; Ethylene Dichloride | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| ELECTRONIC COMPONENTS MANUFACTURING (cont. from previous page; | 164. Semiconductor Manufacturing Wastes | Boric Acid | |
| | 165. Halogenated Solvents from cleaning and drying | Trichloroethylene; 1,1,1-Trichlorethane Perchloroethylene; Freon; Methylene Chloride; Mixed Solvents and Sludges; Heavy Metals (Cadmium; Lead; Zinc; Chromium); Oils | |
| | 166. Non-halogenated Solvents from machining, forming (aciding) and coating operations | Acetone; Isopropyl Alcohol; Methanol; Methyl Ethyl Ketone; Photoresist; Xylene; Mixed Solvents | |
| | 167. Non-halogenated solvents from cleaning and drying | Methanol; Acetone; Isopropyl Alcohol; Methyl Ethyl Ketone; (All contain heavy metals, oils) | |
| | 168. Wastewater treatment sludges from machining, chemical/electrochemical and coating operations | Heavy Metals; Fluoride; | |
| | 169. Oils from machining, forming, and plastic thermoforming operations | Oil; Heavy Metals (Cadmium; Chromium; Copper; Lead; Zinc) | |
| | 170. Paint wastes from coating operations | Lead; Zinc; Chromium; Solvents | |
| ELECTROPLATING AND METAL FINISHING | 171. Wastewater treatment sludges (Metal rinse to remove concentrated process solutions) | Cyanides; Copper; Chromium; Tin; Nickel; Zinc; Lead; Cadmium; Fluoride | Hazardous components generated by the electroplating and metal finishing industries are sparsely covered in CHRIS and |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| ELECTROPLATING AND METAL FINISHING (cont. from previous page) | 172. Process wastes (pre- and post plating preparation wastes and miscellaneous metallic wastes) | Metals (noted above); Oil and Grease; Asbestos; Cyanides; Solvents | EPA. OHM-TADS has the most complete list, and yet that does not cover many wastes. Metals are covered by all three manuals. The EPA manual has a complete listing for hazardous components generated by acid, copper plating wastes, and nickel plating wastes. Metals, oil and grease, solvents, and phosphates are too general to be covered by any manual. Asbestos, copper cyanide, zinc phosphate, zinc chromate, cadmium cyanide, ferric oxide, cupric oxide, chromic hydroxide sludge, diphenyl ether, lead carbonate, copper pyrophosphate, sodium pyrophosphate, and stannic chloride are not included in any manual. |
| | 173. Degreaser sludges (solvents and removed soils in cleaning operations) | Solvents | |
| | 174. Salt precipitates from electroless nickel bath regeneration | Nickel | |
| | 175. Aluminum anodizing bath with drag-out | Chromium; Aluminum Sulfate; Sulfuric Acid | |
| | 176. Brass plating wastes | Copper Cyanide; Zinc Cyanide; Zinc Phosphate; Zinc Chromate; Hydrogen Cyanide | |
| | 177. Cadmium plating wastes | Cadmium; Cadmium Cyanide; Hydrogen Cyanide | |
| | 178. Chrome plating wastes | Chromates ($Cr^{+6}$) Sod.; $Fe_2O_2$; CuO; Chromic Sulphate; Chromic Hydroxide Sludge | |
| | 179. Cyanide Copper plating wastes | Copper Cyanide; Hydrogen Cyanide | |
| | 180. Silver plating wastes | Silver Cyanide; Hydrogen Cyanide | |
| | 181. Waste scavenging catalyst | Copper Chlorides; Organics (Diphenyl Ether) | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| ELECTROPLATING AND METAL FINISHING (cont. from previous page) | 182. From Laboratories and Plants using lead | Lead Carbonate; Lead Acetate; Lead Nitrate | |
| | 183. Acid Copper plating wastes | Copper Sulfate; Sulfuric Acid | |
| | 184. Nickel plating wastes | Nickel Chloride; Nickel Sulfate | |
| | 185. Pyrophosphate Copper plating wastes | Copper Pyrophosphate; Sodium Pyrophosphate | |
| | 186. Tin plating wastes | Stannic Chloride; Stannous Chloride; Hydrogen Fluoride | |
| | 187. Phosphate Sludges from metal coating operations | Phosphates; Iron; Zinc; Sodium; Nickel; Lead; Calcium; Manganese; Hexane Solubles | |
| RUBBER | 188. Waste materials from devulcanization in the manufacturing of reclaimer rubber | Oils; Dipentene; Coal Tar; Petroleum Resins | Oils, dipentene, coal tar, petroleum resins, phenyl-B-napthylamin, benzothiazyl disulfide, phenylene diamine, lead dimethyl dithiocarbonate, trimethyl dihydroquinolin polymer and nitro benzene are the hazardous components generated by the rubber industry. Only dipentene, lead, and nitrobenzene are listed. None of the manuals adequately list pollutants generated during the manufacture of rubber products. Both the CHRIS and EPA manuals only list nitrobenzene. |
| | 189. Process and solvent wastes in the manufacturing of hose and belting | Phenyl-B-Naphthylamin; Benzothiazyl Disulfide; Phenylene Diamine; Lead Dimethyl Dithiocarbonate; Trimethyl Dihydroquinolin Polymer | |
| | 190. Nitro Benzene from rubber industry wastes | Nitro Benzene | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| LEATHER AND LEATHER PRODUCTS | 191. Trim and shavings from complete chrome tanneries | Chromium | All components are listed by at least one manual with the exception that solvents is too general. CHRIS and EPA manuals do not always list the metal element but include compounds of the metal. The EPA manual only lists copper and sodium sulfide specifically, while CHRIS only lists the latter. |
| | 192. Unfinished leather trimmings, buffing dust, finished leather trim, wastewater screenings from complete chrome tanneries | Chromium; Lead | |
| | 193. Finishing residue from complete chrome tanneries | Solvents; Chromium; Zinc; Lead | |
| | 194. Wastewater treatment sludge from complete chrome tanneries | Chromium; Lead; Copper | |
| | 195. Chrome fleshings, unfinished leather trimmings, buffing dust, wastewater screenings from sheepskin tanneries | Chromium; Lead; Zinc; Copper | |
| | 196. Buffing dust from leather finishers | Chromium; Zinc | |
| | 197. Finishing residue from | Solvents; Chromium; Zinc; Lead | |
| | 198. Wastewater sludge from tanhouse | Chromium; Lead | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| LEATHER AND LEATHER PRODUCTS (cont. from previous page) | 199. Trim and shaving wastes from tannery finishers e.g., unfinished leather trimmings, wastewater screenings, buffing dust, finished leather trin | Chromium; Lead | |
| | 200. Residues from tannery finishers | Solvents, Chromium; Zinc; Lead | |
| | 201. Chrome Tan Liquor from manufacture of leather products | Sodium Chromate; Sodium Sulfide | |
| SPECIAL MACHINERY MANUFACTURING | 202. Spent coolants and cutting oils from machine shop operations, e.g., machining; tool and dye; stamping, blanking and forming; plate and structural fabrication; assembly | Oil; Heavy Metals (Cadmium; Lead) | Hazardous components generated by special machinery manufacturing include, cadmium, lead, trichloroethylene, cyanide, oils, acids, alkalies, solvents, copper, nickel, sodium hydroxide, arsenic, arsenic triselenide, sodium cyanide, sodium ferricyanide, freon, ammonium fluoride, hydrofluoric acid, cadmium chromate, and Thallium. Oils, acids and alkalies are not listed specifically by any of the manuals. Most of the hazardous components listed are too general to be listed by manuals. Sodium sulfide, cadmium, lead, cyanide, copper, nickel, sodium hydroxide, zinc, chromium, sodium cyanide, and hydrofluoric acid are listed in al! manuals. |
| | 203. Sweepings and grindings from machine shop operations | Oil; Heavy Metals | |
| | 204. Spent Cleaning Solvents from machine shop operations | Solvents (Trichloroethylene), Heavy Metals (including Lead) | |
| | 205. Metal Rinsing Salts from molten salt bath heating | Cyanide | |
| | 206. Quenching bath solutions from cooling operations | Oils | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| SPECIAL MACHINERY MANUFACTURING (cont. from previous page) | 207. Wastes from cleaning operations | Acids and Alkalies | |
| | 208. Surface preparation and cleaning wastes from electroplating processes. | Acids and Alkalies, Solvents | |
| | 209. Plating tank wastes from electroplating operations | Heavy Metals | |
| | 210. Paints, Solvents, Sludges, Cleaners, Residues from coating operations, e.g., Painting and cleaning | Heavy Metals, Solvents | |
| | 211. Rotogravure printing plate wastes | Copper; Nickel; Lead; Sodium Hydroxide; Zinc; Chromium; Organic Acids | |
| | 212. Duplicating and photo equipment manufacturing wastes | Selenium; Sodium Hydroxide; Arsenic; Arsenic Triselenide | |
| | 213. Computer manufacturing wastes | Sodium Cyanide; Sodium Ferricyanide; Nickel; Zinc; Freon; Ammonium Fluoride; Hydrofluoric Acid; Cadmium Chromate; Thallium | |
| | 214. Graphic arts photography wastes | Ammonium Chromate | |
| PETROLEUM REFINING | 215. Slop Oil Emulsion Solids | Phenols; Heavy Metals; Oil | Hazardous components generated as by-products from petroleum refining include |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PETROLEUM REFINING (cont. from previous page) | 216. Cooling Water Sludge | Phenols; Heavy Metals; Oil | phenols, heavy metals, oil, benz-A-pyrene,cyanide, fluoride, sulfides, mercaptans, acids, bases, organic tar wastes, hydrazine, arsenic compounds, lead salts, mercury salts, tetramethyl lead compounds, isoprene, alcohols aldehydes, carbon tetrachloride and benzene derivatives. Benz-A-Pyrene, dinitro creosol, mercaptans, ethyl mercaptans, methyl mercaptans, butyl aldehydes, diphenyl amine tars, tar, tetramethyl lead gasoline, lead cyanide, and copper cyanide are not listed. Phenols, oil, heavy metals, nitrogen bases, and sulfates are not specific enough to be listed in any manual. OHM-TADS, CHRIS and EPA have numerous listings of the other hazardous components. |
| | 217. Spent Lime from Boiler Feedwater Treatment | Phenols; Oil | |
| | 218. Exchanger Bundle cleaning sludge | Phenols; Heavy Metals; Benz-A-Pyrene; Oil | |
| | 219. Separator Sludge | Phenols; Heavy Metals; Oil | |
| | 220. Dissolved Air Flotation Wastes | Phenols; Heavy Metals; Oil | |
| | 221. Kerosene Filter Clays | Phenols; Heavy Metals; Benz-A-Pyrene; Oil | |
| | 222. Crude Tank Bottoms | Phenols; Benz-A-Pyrene; Oil | |
| | 223. Leaded Tank Bottoms | Phenols; Heavy Metals; Benz-A-Pyrene; Oil | |
| | 224. Non-Leaded Tank Bottoms | Phenols; Cyanide; Heavy Metals; Benz-A-Pyrene; Oil | |
| | 225. Cooling Tower Sludge | Phenols; Heavy Metals; Oil | |
| | 226. Neutralized Hydrofluroic Acid Alkylation Sludges | Phenols; Fluoride | |
| | 227. Storm Water Silt | Phenols; Heavy Metals; Benz-A-Pyrene; Oil | |
| | 228. Biological Treatment Sludges | Phenols; Heavy Metals; Oil | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PETROLEUM REFINING (cont. from previous page) | 229. Catalyst Fines | Phenols; Heavy Metals; Oil | |
| | 230. Coke Fines | Phenols; Heavy Metals | |
| | 231. Filter Clays | Phenols; Heavy Metals; Benz-A-Pyrene; Oil | |
| | 232. Petroleum Refining Sour Wastes | Sodium Sulfides; Hydrogen Sulfide; Ammonium Sulfide; Phenol; Mercury Mercaptans; Ethyl Mercaptans; Methyl Mercaptans; Acetic Acid; Cyanides; Nitrogen Bases | |
| | 233. Petroleum Refinery Spent Caustics | Sulfates; Dinitrocresols; Mercaptans; Phenol; Lead; Sodium Hydroxide | |
| | 234. Petroleum Refining Aldehyde Wastes | Acetaldehyde; Butyl Aldehyde; Formaldehyde; Furfural | |
| | 235. Organic Tar Wastes | Diphenylamine Tars; Toluene; Ethyl Benzene; Ethylene Dichloride; Ethylene Glycol; Ethylene Oxide; Formic Acid; Tar; Thallium; Toluene; Vinyl Acetate; Chloric Acid; Nitric Acid; Phosphoric Acid; Sodium Hydroxide | |
| | 236. Copper and Lead Bearing Wastes | Lead Cyanides; Lead Nitrates; Copper Nitrate; Copper Cyanide | |
| | 237. Jet and Rocket Fuel Storage and Use Wastes | Hydrazine | |
| | 238. Still Bottoms (stored) | Arsenic Trichloride | |

continued

## TABLE B-1. (continued)

| Industry | Waste Stream | Hazardous Components | Applicability |
|---|---|---|---|
| PETROLEUM REFINING (cont. from previous page) | 239. Waste Brine Sludges | Lead Salts; Mercury Salts | |
| | 240. Wastes from Gasoline Cleansing Operations | Tetramethyl Lead; Tetramethyl Lead Gasoline | |
| | 241. Off-Specification Liquids | Isoprene | |
| | 242. Miscellaneous Petroleum Refining Wastes | Allyl Alcohol; Amyl Alcohol; Butanol; Ethol; Isobutyl Alcohol; Isopropyl Alcohol; Methanol; Benzene; Butadiene; Carbon Tetrachloride | |

## TABLE B-2. DETAILED EVALUATION OF MANUAL APPLICABILITY TO WASTE STREAMS

Legend

| | |
|---|---|
| Y: | Yes, the element or compound is listed |
| N: | No, the element or compound is not listed |
| S: | Some, denotes that various compounds are covered in addition to the pure element |
| NS: | Not specific |
| Sl: | Sludge, denotes that the waste is in the form of a sludge |

A number will denote the types covered and a suffix of "i" denotes isotopes while "s" denotes synonyms. A number without a suffix denotes the number of compounds listed.

| Waste Stream | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|
| (SPECIAL CHEMICALS) | | | |
| Aloperidin | N | N | N |
| Amantadine | N | N | N |
| 4-Aminoantipyrin Acetamide | N | N | N |
| Aminopterin | N | N | N |
| 3-Amino-1,2,4-triazole | N | N | N |
| Asbestiform fibers | N | N | N |
| 6-Azuridine | N | N | N |
| Azo dyes | N | N | N |
| Benzene | Y | Y | Y |
| Bisulfan | N | N | N |
| Carbon Tetrachloride | Y | Y | N |
| Chloroquine | N | N | N |
| Chlorambucil | N | N | N |
| Cobalt Salts | 3 | N | 4 |
| Colchicine | N | N | N |
| Coumarin derivatives | N | N | N |
| Cyasin | N | N | N |
| Cyclophosphamide | N | N | N |
| Dextroamphetamine Sulfate | N | N | N |

continued

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TABLE B-2. (continued)

| Waste Stream | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|
| Diazepan (valium) | N | N | N |
| Diethylstilbesterol | N | N | N |
| Dimethylaminoazo-benzene | N | N | N |
| Dimethylnitrosamine | N | N | N |
| Diphenylhydantoin | N | N | N |
| Ethionine | N | N | N |
| Grisefulvin | N | N | N |
| 1-Hydroxysafrole | N | N | N |
| Maleic Hydrazide | N | N | N |
| Methotrexate | N | N | N |
| Methylthiouracil | N | N | N |
| Mytomycin-C | N | N | N |
| d-Penicillamine | N | N | N |
| Phenylalanine | N | N | N |
| Phorbal esters | N | N | N |
| Quinine | Y | N | N |
| Resperine | N | N | N |
| p-Rosanilin | N | N | N |
| Safrole | N | N | N |
| Serotonin | N | N | N |
| Streptomycin | N | N | N |
| Testosterone | N | N | N |
| Thioacetamide thiourea | N | N | N |
| Trimethadione | N | N | N |
| d-Tubocurarine | N | N | N |
| (PHYTOTOXICITY LIST) | | | |
| 2,4-D and Salts | N | N | Y |
| Dalapon | Y | N | Y |
| Dichlobenil | N | N | Y |
| Diquat | N | N | Y |
| Fenac | N | N | N |
| Silvex | Y | N | N |
| Picloram | N | N | N |

continued

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* EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| | Waste Stream | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 1. | Dye stuff | NS | NS | NS |
| | Zinc compounds | 4 | 1 | 16 |
| 2. | Dye stuff | NS | NS | NS |
| | Chlorinated organics | NS | NS | NS |
| | Compounds of: | | | |
| | Arsenic | Y | N | 6 |
| | Barium | 6 | 1 | N |
| | Cadmium | 4 | N | 3 |
| | Chromium | Y | 1 | 16 |
| | Copper | 5 | 1 | 13 |
| | Iron | 7 | 1 | 9 |
| | Lead | 6 | 1 | 14 |
| | Magnesium | 2 | N | N |
| | Manganese | Y | N | N |
| | Mercury | 2 | Y | 6 |
| | Zinc | 4 | 1 | 16 |
| 3. | Flammables | NS | NS | NS |
| 4. | Copper chlorides | 1 | N | Y |
| | Diphenyl ether | N | N | N |
| | Organics | NS | NS | NS |
| 5. | Lead | 6 | N | 14 |
| | Aluminum chloride | N | Y | N |
| | Hydrochloric acid | Y | Y | N |
| | Salts | NS | NS | NS |
| 6. | Chlorinated hydrocarbons | NS | NS | NS |
| 7. | Phenols | NS | NS | NS |
| 8. | Formaldehyde | Y | Y | Y |
| 9. | Antimony | 5 | 1 | 7 |
| | Cadmium | 4 | 1 | 3 |
| | Manganese | Y | N | N |
| 10. | Solvents | NS | NS | NS |
| 11. | Solvents | NS | NS | NS |

continued

* EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| | Waste Stream | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 12. | Dithiocarbamate | N | N | N |
| | Ethylenediamine | Y | Y | Y |
| 13. | Heavy Metals | NS | NS | NS |
| 14. | Solvents | NS | NS | NS |
| | Allyl chloride | Y | Y | Y |
| | Methyl mercuric chloride | N | N | N |
| 15. | Mercury | 2 | Y | 6 |
| | Aliphatic mercury compounds | N | N | N |
| | Aromatic mercury compounds | N | N | N |
| 16. | Nitrobenzene | N | Y | Y |
| | Antimony pentafluoride | N | N | Y |
| 17. | Cadmium | 4 | 1 | 3 |
| | Selenate | N | N | N |
| | Selenium | Y | N | 1 |
| 18. | Acetic acid | Y | Y | Y |
| | Sulfuric acid | Y | Y | Y |
| | Mercury chlorides | N | N | N |
| | Methyl methacrylate | Y | Y | Y |
| | Ethyl cellosolve | N | N | N |
| 19. | Phenols | NS | NS | NS |
| | Carbon tetrachloride | Y | Y | N |
| | Chloroform | Y | Y | Y |
| 20. | Zinc chloride | Y | Y | Y |
| | Cuprammonium Wastes | NS | NS | NS |
| | Copper | 5 | 1 | 13 |
| | Sulfuric acid | Y | Y | Y |
| | Ammonia | Y | Y | Y |
| 21. | Adiponitrile | Y | Y | Y |
| | Polymer solids | NS | NS | NS |
| | Various organic solvents | NS | NS | NS |
| | Hydrogen cyanide | N | Y | Y |
| | Phosgene | Y | N | Y |
| | Toluene disocyanate | Y | Y | N |
| | Toluene | Y | N | Y |

continued

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TABLE B-2. (continued)

| Waste Stream | OHM-TADS | CHRIS | EPA * |
|---|---|---|---|
| 22a. Copper | 5 | 1 | 13 |
| Mercury | 2 | Y | 6 |
| Arsenic | Y | N | 6 |
| Zinc | 4 | 1 | 16 |
| Chromium | Y | 1 | 16 |
| 22b. Ethylene dichloride | Y | Y | N |
| Methylene chloride | Y | N | N |
| 22c. Acetone | Y | Y | N |
| Methanol | Y | Y | N |
| Isopropyl alcohol | Y | Y | N |
| Toluene | Y | N | Y |
| Benzene | Y | Y | Y |
| Acetonitrile | Y | Y | Y |
| Xylene | N | Y | Y |
| 22d. Amyl Acetate | N | Y | Y |
| Butanol | N | Y | N |
| Butyl Acetate | N | Y | Y |
| Methylisobutyl Ketone | Y | Y | N |
| Acetate | NS | NS | NS |
| Ethylene Glycol | Y | Y | N |
| Monomethyl Ether | N | N | N |
| 22e. Methanol | Y | Y | N |
| Acetone | Y | Y | N |
| Ethanol | N | Y | N |
| Chloroform | Y | Y | Y |
| Heptane | Y | Y | N |
| Naptha | N | 3 | N |
| Benzene | Y | Y | Y |
| 22f. Ethanol | N | Y | N |
| Methanol | Y | Y | N |
| Acetone | Y | N | N |
| 22g. Terpenes | N | N | N |
| Steroids | N | N | N |
| Vitamins | N | N | N |
| Tranquilizers | N | N | N |
| aq. Ethanol | NS | NS | NS |
| Antivival vaccine | NS | NS | NS |

continued

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* EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| | Waste Stream | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 22g. | (continued) | | | |
| | Toxoids | NS | NS | NS |
| | Serium | N | N | N |
| 23. | Mercury | 2 | Y | 6 |
| | Aliphatic mercury compounds | N | N | N |
| | Aromatic mercury compounds | N | N | N |
| 24. | Phosgene | Y | Y | Y |
| 25. | Inorganic arsenites | N | 2 | 3 |
| | Organic arsenites | N | N | N |
| | Arsenylic acid | N | N | N |
| | Sodium chloride | N | Y | N |
| 26. | Dimethyl foramide | N | Y | N |
| | Methyethyl Ketone | Y | Y | N |
| | Acetonitrile | Y | Y | N |
| | Caustic | 2 | 2 | 2 |
| | Benzylchloride | N | N | Y |
| | Fluorobenzoic acid | N | N | N |
| | Dichlorobenzene | Y | 2 | N |
| | Trichlorobenzene | Y | N | N |
| | Activated carbon | N | N | N |
| | Chlorobenzene | Y | Y | Y |
| | Toluene | Y | N | Y |
| | Methanol | Y | Y | N |
| | Methylene dichloride | N | N | N |
| | Pyridine | Y | Y | N |
| | Tetrachloroethane | N | N | N |
| | Trichloroethylene | Y | Y | N |
| | Benzo-trifluoride | N | N | N |
| | Chlorosulfonic acid | Y | Y | Y |
| | Diphenyl amine wastes | N | N | N |
| 27. | Lead | 6 | 1 | 14 |
| | Asbestos | N | N | N |
| | Chlorinated hydrocarbons | NS | NS | NS |
| 28. | Mercury | 2 | Y | 6 |
| | Chlorinated hydrocarbons | NS | NS | NS |

continued

*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| | Waste Stream | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 29. | Chromium | Y | 1 | 16 |
| | Cadmium | 4 | 1 | 3 |
| | Cyanide | 7 | 4 | 6 |
| | Lead | 6 | 1 | 14 |
| | Zinc | 4 | 1 | 16 |
| 30. | Fluoride | 2 | 2 | 7 |
| 31. | Fluoride | 2 | 2 | 7 |
| 32. | Chromium | Y | 1 | 16 |
| 33. | Phosphorous | Y | N | Y |
| | Phosphates | NS | NS | NS |
| | Arsenic | Y | N | 6 |
| 34. | Mercury salts | N | N | 6 |
| | Aliphatic organomercury | N | N | N |
| | Calcium Oxide | N | Y | Y |
| | Asbestos | N | N | N |
| | Lead | 6 | 1 | 14 |
| | Chlorinated hydrocarbons | NS | NS | NS |
| | Sulfuric acid | Y | Y | Y |
| 35. | Diborane | Y | N | N |
| | Pentaborane | Y | N | N |
| | Decaborane | Y | N | N |
| 36. | Nickel carbonyl | N | N | N |
| 37. | Chlorine Triflourine | N | N | N |
| 38. | Chlorine Pentafluoride | N | N | N |
| 39. | Bromine Pentafluoride | N | N | N |
| 40. | Arsenates | 2 | N | 3 |
| 41. | Organic Chloride | NS | NS | NS |
| | Chromic Sulfate | N | N | Y |
| | Zinc Chloride | Y | Y | Y |

continued

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* EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| | Waste Stream | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 42. | Silicon Terrafluoride | N | N | N |
| | Carbon Tetrafluoride | N | N | N |
| | Hydrogen Fluoride | N | Y | N |
| | Carbon Dioxide | N | N | N |
| | Fluorine | Y | Y | 7 |
| 43. | Chromium Salts | 5 | 1 | 15 |
| | Sodium Sulfate | Y | N | N |
| 44. | Barium Carbonate | Y | Y | N |
| | Barium Chloride | Y | N | N |
| | Barium Cyanide | Y | N | N |
| | Barium Nitrate | Y | N | N |
| | Barium Sulfide | N | N | N |
| 45. | Perchloric Acid | Y | N | N |
| 46. | Mercuric Cyanide | N | N | Y |
| 47. | Antimony Pentafluoride | N | N | Y |
| 48. | Fluorine | Y | Y | 7 |
| | Hydrogen Fluoride | N | Y | N |
| 49. | Phenols | NS | NS | NS |
| | Organic Chlorides | NS | NS | NS |
| 50. | Dichlorobenzene | Y | 2 | N |
| | Trichlorobenzene | Y | N | N |
| | Tar | N | N | N |
| 51. | Tetranitromethane | N | N | N |
| 52. | Diphenylamine | N | N | N |
| 53. | Toluene Di-isocyanate | Y | Y | N |
| 54. | Maleic Anhydride | Y | Y | Y |
| 55. | Phenol | Y | Y | Y |

continued

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*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| | Waste Stream | | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|---|
| 56. | Nitrobenzene | | N | Y | Y |
| | Aniline | | Y | Y | Y |
| | Chlorobenzene | | Y | Y | Y |
| | Amyl Amine | | N | N | N |
| 57. | Dinitrophenol | | N | Y | Y |
| 58. | Maleic Acid | | Y | N | Y |
| | Tars | | N | N | N |
| | Maleic Anhydride | | Y | Y | Y |
| 59. | Meta-Nitrochlorobenzene | | N | N | N |
| 60. | Meta-Nitrochlorobenzene | | N | N | N |
| | Para-Nitrochlorobenzene | | N | N | N |
| 61. | Hydrogen Bromide | | N | N | N |
| 62. | Hydrogen Cyanide | | N | Y | Y |
| 63. | Ammonium Silicofluoride | | N | N | N |
| | Fluoracetic Acid | | N | N | N |
| 64. | Lead Carbonate | | N | N | N |
| | Lead Acetate | | Y | N | Y |
| | Lead Nitrate | | Y | N | Y |
| 65. | Sodium Azide | | Y | N | N |
| 66. | Phosphorous(309) | no specific isomers | Y | Y | Y |
| | Sodium Phosphate(371) | | Y | N | 3 |
| | Sodium Fluoride(359) | | Y | Y | N |
| 67. | Ammonium Fluoride | | N | N | N |
| | Ammonium Bifluoride | | N | N | N |
| | Potassium Fluoride | | N | N | N |
| | Potassium Bifluoride | | N | N | N |
| | Sodium Fluoride | | Y | Y | N |
| | Sodium Bifluoride | | N | N | N |
| | Hydrofluoric Acid | | Y | Y | Y |

continued

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*EPA = Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| | Waste Stream | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 68. | Chromic Sulfate | N | N | Y |
| | Organic Chloride | NS | NS | NS |
| | Sodium Sulfides (372) no sp. isomer | NS | Y | Y |
| 69. | Chromic Sulfate | N | N | Y |
| | Carbon Tetrachloride | Y | Y | N |
| | Chloroform | Y | Y | Y |
| | Trichloro-meltrane | N | N | N |
| | Trichloromeltrene | N | N | N |
| 70. | Sodium Cyanate | Y | N | N |
| | Sodium Cyanide | Y | Y | Y |
| | Sodium Hypochlorite | N | Y | Y |
| 71. | Potassium Chromate | Y | N | N |
| | Potassium Dichromate | Y | Y | N |
| 72. | Chromium | Y | 1 | 16 |
| | Copper | 5 | 1 | 13 |
| | Cadmium | 4 | 1 | 3 |
| | Mercury | 2 | Y | 6 |
| | Manganese | Y | N | N |
| | Nickel | 5 | 1 | 6 |
| | Lead | 6 | 1 | 14 |
| | Antimony | 5 | 1 | 7 |
| | Selenium | Y | N | 1 |
| | Zinc | 4 | 1 | 16 |
| 73. | Copper | 5 | 1 | 13 |
| | Lead | 6 | 1 | 14 |
| | Zinc | 4 | 1 | 16 |
| 74. | Copper | 5 | 1 | 13 |
| | Arsenic | Y | N | 6 |
| | Lead | 6 | 1 | 14 |
| | Zinc | 4 | 1 | 16 |
| 75. | Copper | 5 | 1 | 13 |
| | Manganese | Y | N | N |
| | Nickel | 5 | 1 | 6 |
| | Lead | 6 | 1 | 14 |

continued

*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| Waste Stream | | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 76. | Copper | 5 | 1 | 13 |
| | Lead | 6 | 1 | 14 |
| | Zinc | 4 | 1 | 16 |
| 77. | Phenol | Y | Y | Y |
| | Cyanide | 7 | 4 | 6 |
| 78. | Phenol | Y | Y | Y |
| | Oil and Grease | NS | NS | NS |
| 79. | Lead | 6 | 1 | 14 |
| 80. | Chromium | Y | 1 | 16 |
| | Lead | 6 | 1 | 14 |
| 81. | Chromium | Y | 1 | 14 |
| | Copper | 5 | 1 | 13 |
| | Manganese | Y | N | N |
| | Nickel | 5 | 1 | 6 |
| | Lead | 6 | 1 | 14 |
| | Zinc | 4 | 1 | 16 |
| | Oil and Grease | NS | NS | NS |
| 82. | -- | | | |
| 83. | Acid | NS | NS | NS |
| | Chromium | Y | 1 | 16 |
| | Copper | 5 | 1 | 13 |
| | Manganese | Y | N | N |
| | Nickel | 5 | 1 | 6 |
| | Lead | 6 | 1 | 14 |
| | Zinc | 4 | 1 | 16 |
| 84. | Zinc | 4 | 1 | 16 |
| | Lead | 6 | 1 | 14 |
| 85. | Chrome | N | N | N |
| | Lead | 6 | 1 | 14 |
| 86. | Copper | 5 | 1 | 13 |
| | Zinc | 4 | 1 | 16 |

continued

*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| Waste Stream | OHM-TADS | CHRIS | EPA * |
|---|---|---|---|
| 87. Mercury | 2 | Y | 6 |
| 88. Nickel Carbonyl | N | N | N |
| 89. Thallium | 2 | N | N |
| Thallium Sulfate | N | N | N |
| 90. Phenol | Y | Y | Y |
| Sodium Cyanide | Y | Y | Y |
| Sodium Fluorides | Y | Y | N |
| Ammonia | Y | Y | Y |
| Sulfur Acid | Y | Y | Y |
| Chromic Sulfate | N | Y | Y |
| Zinc Chloride | Y | Y | Y |
| Hypochloridic Acid | N | N | N |
| 91. Phenol | Y | Y | Y |
| Sodium Cyanide | Y | Y | Y |
| Ammonia | Y | Y | Y |
| 92. Phenol | Y | Y | Y |
| Sodium Cyanide | Y | Y | Y |
| Ammonia(19) no specific isomer | Y | Y | Y |
| Tar Acids | N | N | N |
| Thiocyanate | N | N | N |
| Thiosulfate | N | N | N |
| Pyridine | Y | Y | N |
| Hydrogen Cyanide | N | Y | Y |
| 93. Hydrofluoric Acid | Y | Y | Y |
| Sulfuric Acid | Y | Y | Y |
| Iron | 7 | 1 | 9 |
| Chromium | Y | 1 | 6 |
| Nickel | 5 | 1 | 6 |
| Cobalt | 4 | 4 | N |
| Nitric Acid | Y | Y | Y |
| 94. Copper Sulfate | Y | Y | Y |
| Zinc | 4 | 1 | 16 |
| Sodium Dichromate | Y | Y | Y |
| Sulfuric Acid | Y | Y | Y |
| Bright Dip Liquor | N | N | N |

continued

* EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| | Waste Stream | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 95. | Arsenic Trioxide | N | N | Y |
| | Selenium | Y | N | 1 |
| | Sulfuric Acid | Y | Y | Y |
| | Hydrochloric Acid | Y | Y | Y |
| | Copper | 5 | 1 | 13 |
| | Lead | 6 | 1 | 14 |
| | Mercury | 2 | Y | 6 |
| | Antimony | 5 | 1 | 7 |
| 96. | Selenium | Y | N | 1 |
| 97. | Thallium | 2 | N | N |
| 98. | Beryllium Powder | N | N | N |
| | Beryllium Carbonate | N | N | N |
| | Beryllium Chloride | Y | N | Y |
| | Beryllium Hydroxide | N | N | N |
| | Beryllium Oxide | N | N | N |
| | Beryllium Selenate | N | N | N |
| 99. | Zinc plating | N | N | N |
| | Zinc Cyanide | N | N | Y |
| | Sodium Hydroxide | Y | Y | Y |
| | Hydrogen Cyanide | Y | Y | Y |
| 100. | Copper Chloride | Y | N | Y |
| | Diphenyl Ether | N | N | Y |
| 101. | Lead Carbonate | N | N | N |
| | Lead Acetate | Y | N | Y |
| | Lead Nitrate | Y | N | Y |
| 102. | Lead | 6 | 1 | 14 |
| | Aluminum Chloride | N | Y | N |
| | Hydrochloric Acid | Y | Y | Y |
| 103. | Lead | 6 | 1 | 14 |
| 104. | Chlorinated Hydrocarbons | NS | NS | NS |

continued

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*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| Waste Stream | | OHM-TADS | CHRIS | EPA * |
|---|---|---|---|---|
| 105. | Nickel Sulfate | Y | N | Y |
| | Sulfuric Acid | Y | Y | Y |
| | Isobutyl Ketone | N | N | N |
| | Hydrofluoric Acid | Y | Y | Y |
| 106. | Sodium Hydroxide | Y | Y | Y |
| | Potassium Permanganate | Y | Y | Y |
| | Iron | 7 | 1 | 9 |
| | Copper | 5 | 1 | 13 |
| 107. | Sulfuric Acid | Y | Y | Y |
| | Hydrochloric Acid | Y | Y | Y |
| 108. | Copper | 5 | 1 | 13 |
| | Alkaline Wetting Oils | NS | NS | NS |
| 109. | Copper | 5 | 1 | 13 |
| | Nickel | 5 | 1 | 6 |
| | Hydrofluoric Acid | Y | Y | Y |
| | Nitric Acid | Y | Y | Y |
| 110. | Antimony | 5 | 1 | 7 |
| | Antimony Trioxide | Y | Y | Y |
| | Antimony Pentoxide | N | Y | N |
| 111. | Nickel Sulfate | Y | Y | Y |
| | Copper Sulfate | Y | N | Y |
| | Sodium Fluoride | Y | Y | Y |
| | Sodium Hydroxide | Y | Y | Y |
| 112. | Copper | 5 | 1 | 13 |
| | Chromium | 4 | 1 | 6 |
| | Aluminum | 4 | 2 | 1 |
| | Sulfuric Acid | Y | Y | Y |
| | Bichromate | N | N | N |
| 113. | Cyanide | 7 | 4 | 6 |
| | Ferrous Sulfate | Y | Y | Y |
| | Sodium Chromate | Y | N | Y |
| | Zinc Chloride | Y | Y | Y |
| | Chlorinated Solvents | NS | NS | NS |

continued

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*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| Waste Stream | | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 114. | Cadmium | 4 | 1 | 3 |
| | Selenium | Y | N | 1 |
| | Selenates | N | N | N |
| 115. | Pentachlorophenol | Y | Y | Y |
| | Water | N | N | N |
| 116. | Copper | 5 | 1 | 13 |
| | Chromium | Y | 1 | 16 |
| | Phenols | NS | NS | NS |
| | Hydrogen | Y | N | N |
| | Cyanide | 7 | 4 | 6 |
| | Amiline | Y | Y | Y |
| | Disulfonic Acid | N | N | N |
| 117. | Chromates | NS | NS | 11 |
| | Chromic Hydroxide Sludge | N | N | N |
| | Sulfides | NS | NS | NS |
| | Diphenylamine | N | N | N |
| 118. | Chloropicrin | Y | N | N |
| 119. | Tetraethyl Lead | Y | Y | 2s |
| | Tetramethyl Lead | Y | Y | N |
| 120. | Manganese Thiocarbonate | N | N | N |
| | Zinc | 4 | 1 | 16 |
| | Bux Ten | N | N | N |
| | Carbaryl | N | Y | Y |
| | Carbofuran | N | N | N |
| 121. | 2,4-D | Y | Y | 2 |
| | 2,6-D | N | N | N |
| | Mono Phenoxy | N | N | N |
| | Trichloro Phenoxy | N | N | N |
| | Acetic Acid | Y | Y | Y |
| | 2,4,5-T | Y | N | 2 |
| 122. | Antimony Trifluoride | Y | Y | Y |
| 123. | Antimony Pentafluoride | N | N | Y |

continued

*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| | Waste Stream | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 124. | PCB | Y | Y | Y |
| | Alpha Methyl Styrene | N | N | N |
| 125. | TNT | N | N | N |
| | HMX | N | N | N |
| | TDX | N | N | N |
| | PETN | N | N | N |
| | TETRYL | N | N | N |
| | RDX | N | N | N |
| 126. | PNC | N | N | N |
| | Nitro Cellulose | N | N | N |
| | Smokeless Powder | N | N | N |
| 127. | Lead Carbonate | N | N | N |
| | Lead Acetate | Y | N | Y |
| 128. | Hydrazine | Y | Y | N |
| 129. | Powdered Metals | NS | NS | NS |
| | Phosphorous | Y | Y | Y |
| | Tungsten | Y | N | N |
| | Potassium Perchlorate | N | N | N |
| | Barium Chromate | N | N | N |
| | Lead Chromate | N | N | N |
| 130. | Phosphorous | Y | Y | Y |
| | Tungsten | Y | N | N |
| 131. | Tetranitromethane | N | N | N |
| 132. | Sodium Sulfite | Y | Y | N |
| | Sodium Nitrite | Y | N | Y |
| | Sodium Nitrate | N | N | N |
| | Nitrotoluene | N | N | N |
| | Dinitrotoluene | N | N | N |
| | Trinitrotoluene | N | N | N |
| | Acetic Acid | Y | Y | Y |

continued

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*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| | Waste Stream | OHM-TADS | CHRIS | EPA * |
|---|---|---|---|---|
| 133. | Lead Azide Dextrinated | N | N | N |
| | Lead Styphanate | N | N | N |
| | Mannitol Hexanitrate | N | N | N |
| | Mercury Fulminate | N | N | N |
| | Potassium | Y | N | N |
| | Dinitro Benzene Furoxam | N | N | N |
| | Nitro-phenols | NS | NS | NS |
| 134. | Hazardous Solvents | NS | NS | NS |
| | Toxic Pigments | NS | NS | NS |
| 135. | Hazardous Solvents | NS | NS | NS |
| | Toxic Pigments | NS | NS | NS |
| 136. | Toxic Pigments | NS | NS | NS |
| 137. | Toxic Pigments | NS | NS | NS |
| 138. | Hazardous Solvents | NS | NS | NS |
| 139. | Hazardous Solvents | NS | NS | NS |
| 140. | Hazardous Solvents | NS | NS | NS |
| | Toxic Pigments | NS | NS | NS |
| 141. | Hazardous Solvents | NS | NS | NS |
| | Toxic Pigments | NS | NS | NS |
| 142. | Hazardous Solvents | NS | NS | NS |
| | Toxic Pigments | NS | NS | NS |
| 143. | Hazardous Solvents | NS | NS | NS |
| | Toxic Pigments | NS | NS | NS |
| 144. | Hazardous Solvents | NS | NS | NS |
| | Toxic Pigments | NS | NS | NS |
| 145. | Hazardous Solvents | NS | NS | NS |
| | Toxic Pigments | NS | NS | NS |
| 146. | Hazardous Solvents | NS | NS | NS |
| | Toxic Pigments | NS | NS | NS |

continued

*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| Waste Stream | OHM-TADS | CHRIS | EPA * |
|---|---|---|---|
| 147. Hazardous Solvents | NS | NS | NS |
| Toxic Pigments | NS | NS | NS |
| 148. Hazardous Solvents | NS | NS | NS |
| Toxic Pigments | NS | NS | NS |
| 149. Hazardous Solvents | NS | NS | NS |
| Toxic Pigments | NS | NS | NS |
| 150. Lead Carbonate | N | N | N |
| Lead Oxide | N | N | N |
| Cleaners | N | N | N |
| Resins | N | N | N |
| 151. Lead | 6 | 1 | 14 |
| Chromium | Y | 1 | 16 |
| Cadmium | 4 | 1 | 3 |
| Selenium | Y | N | 1 |
| Cyanides | 7 | 4 | 6 |
| 152. Chromium | Y | 1 | 16 |
| Mercury | 2 | Y | 6 |
| 153. Cadmium | 4 | 1 | 3 |
| Selenium | Y | N | 1 |
| Selenates | N | N | N |
| 154. Typical hazardous solvents are: | | | |
| Acetone | Y | Y | N |
| N-Butyl Acetate | N | Y | Y |
| Ethanol | Y | Y | N |
| Diacetone Alcohol | Y | Y | N |
| Ethyl Acetate | Y | Y | N |
| Heptane | Y | Y | N |
| Hexane | Y | Y | N |
| Isopropanol | Y | Y | N |
| MEK | Y | Y | N |
| MIBK | Y | Y | N |
| Methanol | Y | Y | N |
| Mineral Spirits | N | N | N |
| Toluene | Y | N | Y |
| VM Naphtha | N | NS | N |

continued

*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| Waste Stream | | OHM-TADS | CHRIS | EPA * |
|---|---|---|---|---|
| 154. | (continued) | | | |
| | P Naphtha | N | NS | N |
| | Xylene | N | Y | Y |
| 155. | Lead | 6 | 1 | 14 |
| | Lead Compounds | 6 | 1 | 14 |
| 156. | Mercury | 2 | Y | 6 |
| | Zinc | 4 | 1 | 6 |
| 157. | Mercury | 2 | Y | 6 |
| | Zinc | 4 | 1 | 6 |
| 158. | Cadmium Carbonate | N | N | N |
| | Hydroxide | N | N | N |
| | Nickel Carbonate | N | N | N |
| | Copper Hydroxide | N | N | N |
| | Lead Sulfate | Y | N | Y |
| | Arsenic | Y | N | 6 |
| | Antimony | 5 | 1 | 7 |
| 159. | Cadmium Oxide | N | N | N |
| | Nickelic Oxide | N | N | N |
| 160. | Mercury | 2 | Y | 6 |
| 161. | Potassium | 9 | 5 | 2 |
| | Sodium Hydroxide | Y | Y | Y |
| | Lead | 6 | 1 | 14 |
| | Nickel | 5 | 1 | 6 |
| | Chromium | Y | 1 | 16 |
| | Copper | 5 | 1 | 13 |
| | Hydrochloric Acid | Y | Y | Y |
| | Sulfuric Acid | Y | Y | Y |
| | Hydrocyanic Acid | Y | Y | Y |
| | Carbon Tetrachloride | Y | Y | N |
| | Chloroform | Y | Y | Y |
| 162. | Cupric Hydroxide | N | N | N |
| | Calcium Phosphate | Y | N | N |
| | Nicklic Hydroxide | N | N | N |

continued

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*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| | Waste Stream | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 162. | (continued) | | | |
| | Mercury | 2 | Y | 6 |
| | Barium Compounds | 6 | 1 | N |
| | Hydrogen Fluoride | N | Y | N |
| 163. | Ammonium Dichromate | Y | N | Y |
| | Dirt | NS | NS | NS |
| | Organics | NS | NS | NS |
| | Chromic Oxide | N | N | N |
| | Ethylene Dichloride | Y | Y | N |
| 164. | Boric Acid | Y | N | N |
| 165. | Trichloroethylene | Y | Y | N |
| | 1,1,1-Trichloroethane | Y | Y | N |
| | Perchlorothylene | Y | N | N |
| | Freon | N | N | N |
| | Methylene Chloride | Y | N | N |
| | Mixed Solvents | NS | NS | NS |
| | Sludges | NS | NS | NS |
| | Cadmium | 4 | 1 | 3 |
| | Lead | 6 | 1 | 14 |
| | Zinc | 4 | 1 | 16 |
| | Chromium | Y | 1 | 16 |
| | Oils | NS | NS | NS |
| 166. | Acetone | Y | Y | N |
| | Isopropyl Alcohol | Y | Y | N |
| | Methanol | Y | Y | N |
| | Methyl Ethyl Ketone | Y | Y | N |
| | Photoresist | N | N | N |
| | Xylene | N | Y | Y |
| | Mixed Solvents | NS | NS | NS |
| 167. | Methanol | Y | Y | N |
| | Acetone | Y | N | N |
| | Isopropyl Alcohol | Y | Y | N |
| | Methyl Ethyl Ketone | Y | Y | N |
| 168. | Heavy Metals | NS | NS | NS |
| | Fluoride | 2 | 2 | 7 |

continued

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*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| Waste Stream | | OHM-TADS | CHRIS | EPA * |
|---|---|---|---|---|
| 169. | Oil | NS | NS | NS |
| | Cadmium | 4 | 1 | 3 |
| | Chromium | Y | 1 | 16 |
| | Copper | 5 | 1 | 13 |
| | Lead | 6 | 1 | 14 |
| | Zinc | 4 | 1 | 16 |
| 170. | Lead | 6 | 1 | 14 |
| | Zinc | 4 | 1 | 16 |
| | Chromium | Y | 1 | 16 |
| | Solvents | NS | NS | NS |
| 171. | Cyanides | 7 | 4 | 6 |
| | Copper | 5 | 1 | 13 |
| | Chromium | Y | 1 | 16 |
| | Tin | 2 | N | N |
| | Nickel | 5 | 1 | 6 |
| | Zinc | 4 | 1 | 16 |
| | Lead | 6 | 1 | 14 |
| | Cadmium | 4 | 1 | 3 |
| | Fluoride | 2 | 2 | 7 |
| 172. | Metals | NS | NS | NS |
| | Oil and Grease | NS | NS | NS |
| | Asbestos | N | N | N |
| | Cyanide | 7 | 4 | 6 |
| | Solvents | NS | NS | NS |
| 173. | Solvents | NS | NS | NS |
| 174. | Nickel | 5 | 1 | 6 |
| 175. | Chromium | Y | 1 | 16 |
| | Aluminum Sulfate | Y | Y | Y |
| | Sulfuric Acid | Y | Y | Y |
| 176. | Copper Cyanide | N | N | N |
| | Zinc Cyanide | N | N | Y |
| | Zinc Phosphate | N | N | N |
| | Zinc Chromate | N | N | N |
| | Hydrogen Cyanide | Y | Y | Y |

continued

*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| Waste Stream | | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 177. | Cadmium | 4 | 1 | 3 |
| | Cadmium Cyanide | N | N | N |
| | Hydrogen Cyanide | Y | Y | Y |
| 178. | Chromates | NS | NS | 11 |
| | Ferric Oxide | N | N | N |
| | Cupric Oxide | N | N | N |
| | Chromic Sulphate | N | N | Y |
| | Chromic Hydroxide Sludge | N | N | N |
| 179. | Copper Cyanide | N | N | N |
| | Hydrogen Cyanide | N | Y | Y |
| 180. | Silver Cyanide | Y | N | N |
| | Hydrogen Cyanide | Y | Y | Y |
| 181. | Copper Chlorides | Y | N | Y |
| | Diphenyl Ether | N | N | N |
| 182. | Lead Carbonate | N | N | N |
| | Lead Nitrate | Y | N | Y |
| 183. | Copper Sulfate | Y | N | Y |
| | Sulfuric Acid | Y | Y | Y |
| 184. | Nickel Chloride | Y | N | Y |
| | Nickel Sulfate | Y | Y | Y |
| 185. | Copper Pyrophosphate | N | N | N |
| | Sodium Pyrophosphate | N | N | N |
| 186. | Stannic Chloride | N | N | N |
| | Stannous Chloride | Y | N | N |
| | Hydrogen Fluoride | N | Y | N |
| 187. | Phosphates | NS | NS | NS |
| | Iron | 7 | 1 | 9 |
| | Zinc | 4 | 1 | 16 |
| | Sodium | 42 | 17 | 12 |
| | Nickel | 5 | 1 | 6 |
| | Lead | 6 | 1 | 14 |
| | Calcium | 11 | 5 | 4 |

continued

*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| Waste Stream | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|
| 187. (continued) | | | |
| Manganese | Y | N | N |
| Hexane Solubles | NS | NS | N |
| 188. Oils | NS | NS | NS |
| Dipentene | Y | N | N |
| Coal Tar | N | N | N |
| Petroleum Resins | N | N | N |
| 189. Phenyl-P-Naphthylamin | N | N | N |
| Benzothiazyl | N | N | N |
| Disulfide | N | N | N |
| Phenylene Diamine | N | N | N |
| Lead | 6 | 1 | 14 |
| Dimethyl Dithiocarbonate | N | N | N |
| Trimethyl Dihydrogumolin Polymer | N | N | N |
| 190. Nitrobenzene | N | Y | Y |
| 191. Chromium | Y | 1 | 16 |
| 192. Chromium | Y | 1 | 16 |
| Lead | 6 | 1 | 14 |
| 193. Solvents | NS | NS | NS |
| Chromium | Y | 1 | 16 |
| Zinc | 4 | 1 | 16 |
| Lead | 6 | 1 | 14 |
| 194. Chromium | Y | 1 | 16 |
| Lead | 6 | 1 | 14 |
| Copper | 5 | 1 | 13 |
| 195. Chromium | Y | 1 | 16 |
| Lead | 6 | 1 | 14 |
| Zinc | 4 | 1 | 16 |
| Copper | 5 | 1 | 13 |
| 196. Chromium | Y | 1 | 16 |
| Zinc | 4 | 1 | 4 |

continued

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*EPA - Manual for Control of Hazardous Spills - Volumel

TABLE B-2. (continued)

| Waste Stream | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|
| 197. Solvents | NS | NS | NS |
| Chromium | Y | 1 | 16 |
| Zinc | 4 | 1 | 16 |
| Lead | 6 | 1 | 14 |
| 198. Chromium | Y | 1 | 16 |
| Lead | 6 | 1 | 14 |
| 199. Chromium | Y | 1 | 16 |
| Lead | 6 | 1 | 14 |
| 200. Solvents | NS | NS | NS |
| Chromium | Y | 1 | 16 |
| Zinc | 4 | 1 | 16 |
| Lead | 6 | 1 | 14 |
| 201. Sodium Chromate | Y | N | Y |
| Sodium Sulfide | Y | Y | Y |
| 202. Oil | NS | NS | NS |
| Cadmium | 4 | 1 | 3 |
| Lead | 6 | 1 | 14 |
| 203. Oil | NS | NS | NS |
| Heavy Metals | NS | NS | NS |
| 204. Trichloroethylene | Y | Y | N |
| Lead | 6 | 1 | 14 |
| 205. Cyanide | 7 | 4 | 6 |
| 206. Oils | NS | NS | NS |
| 207. Acid | NS | NS | NS |
| Alkalies | NS | NS | NS |
| 208. Acid | NS | NS | NS |
| Alkalies | NS | NS | NS |
| Solvents | NS | NS | NS |
| 209. Heavy Metals | NS | NS | NS |

continued

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*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| | Waste Stream | OHM-TADS | CHRIS | EPA * |
|---|---|---|---|---|
| 210. | Heavy Metals | NS | NS | NS |
| | Solvents | NS | NS | NS |
| 211. | Copper | 5 | 1 | 13 |
| | Nickel | 5 | 1 | 6 |
| | Lead | 6 | 1 | 14 |
| | Sodium Hydroxide | Y | Y | Y |
| | Zinc | 4 | 1 | 16 |
| | Chromium | Y | 1 | 16 |
| | Organic Acids | NS | NS | NS |
| 212. | Selenium | Y | N | 1 |
| | Sodium Hydroxide | Y | Y | Y |
| | Arsenic | Y | N | 6 |
| | Arsenic Triselenide | N | Y | N |
| 213. | Sodium Cyanide | Y | Y | Y |
| | Sodium Ferrocyanide | Y | Y | N |
| | Nickel | 5 | 1 | 6 |
| | Zinc | 4 | 1 | 16 |
| | Freon | N | N | N |
| | Ammonium Fluoride | N | N | N |
| | Hydrofluoric Acid | Y | Y | Y |
| | Cadmium Chromate | N | N | N |
| | Thallium | 2 | N | N |
| 214. | Ammonium Chromate | Y | N | Y |
| 215. | Phenols | NS | NS | NS |
| | Heavy Metals | NS | NS | NS |
| | Oil | NS | NS | NS |
| 216. | Phenols | NS | NS | NS |
| | Heavy Metals | NS | NS | NS |
| | Oil | NS | NS | NS |
| 217. | Phenols | NS | NS | NS |
| | Oil | NS | NS | NS |

continued

*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| Waste Stream | | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 218. | Phenols | NS | NS | NS |
| | Heavy Metals | NS | NS | NS |
| | Benz-A-Pyrene | N | N | N |
| | Oil | NS | NS | NS |
| 219. | Phenols | NS | NS | NS |
| | Heavy Metals | NS | NS | NS |
| | Oil | NS | NS | NS |
| 220. | Phenol | NS | NS | NS |
| | Heavy Metal | NS | NS | NS |
| | Oil | NS | NS | NS |
| 221. | Phenols | NS | NS | NS |
| | Heavy Metals | NS | NS | NS |
| | Benz-A-Pyrene | N | N | N |
| | Oil | NS | NS | NS |
| 222. | Phenols | NS | NS | NS |
| | Benz-A-Pyrene | N | N | N |
| | Oil | NS | NS | NS |
| 223. | Phenols | NS | NS | NS |
| | Heavy Metals | NS | NS | NS |
| | Benz-A-Pyrene | N | N | N |
| | Oil | NS | NS | NS |
| 224. | Phenols | NS | NS | NS |
| | Cyanide | 7 | 4 | 6 |
| | Heavy Metals | NS | NS | NS |
| | Benz-A-Pyrene | N | N | N |
| | Oil | NS | NS | NS |
| 225. | Phenols | NS | NS | NS |
| | Heavy Metals | NS | NS | NS |
| | Oil | NS | NS | NS |
| 226. | Phenols | NS | NS | NS |
| | Fluoride | 2 | 2 | 7 |

continued

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*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| Waste Stream | | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 227. | Phenol | NS | NS | NS |
| | Heavy Metals | NS | NS | NS |
| | Benz-A-Pyrene | N | N | N |
| | Oil | NS | NS | NS |
| 228. | Phenol | NS | NS | NS |
| | Heavy Metal | NS | NS | NS |
| | Oil | NS | NS | NS |
| 229. | Phenol | NS | NS | NS |
| | Heavy Metal | NS | NS | NS |
| | Oil | NS | NS | NS |
| 230. | Phenols | NS | NS | NS |
| | Heavy Metals | NS | NS | NS |
| 231. | Phenols | NS | NS | NS |
| | Heavy Metals | NS | NS | NS |
| | Benz-A-Pyrene | N | N | N |
| | Oil | NS | NS | NS |
| 232. | Sodium Sulfide | Y | Y | Y |
| | Hydrogen Sulfide | Y | Y | N |
| | Ammonium Sulfide | Y | N | Y |
| | Phenol | Y | Y | Y |
| | Mercury | 2 | Y | 6 |
| | Mercaptans | NS | N | N |
| | Ethyl Mercaptans | N | N | N |
| | Methyl Mercaptans | N | N | N |
| | Acetic Acid | Y | Y | Y |
| | Cyanides | 7 | 4 | 6 |
| | Nitrogen Bases | NS | NS | NS |
| 233. | Sulfates | NS | NS | NS |
| | Dinitro cresols | N | N | N |
| | Mercaptans | N | N | N |
| | Phenol | Y | Y | Y |
| | Lead | 6 | 1 | 14 |
| | Sodium Hydroxide | Y | Y | Y |

continued

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*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

| | Waste Stream | OHM-TADS | CHRIS | EPA * |
|---|---|---|---|---|
| 234. | Acetaldehyde | Y | Y | Y |
| | Butyl Aldehyde | N | N | N |
| | Formaldehyde | Y | Y | Y |
| | Furfural | Y | Y | Y |
| 235. | Diphenylamine Tars | N | N | N |
| | Toluene | Y | N | Y |
| | Ethyl Benzene | Y | Y | Y |
| | Ethylene Dichloride | Y | Y | N |
| | Ethylene Glycol | Y | Y | N |
| | Ethylene Oxide | Y | N | N |
| | Formic Acid | Y | Y | Y |
| | Tar | N | N | N |
| | Thallium | Y | N | N |
| | Vinyl Acetate | Y | Y | Y |
| | Chloric Acid | Y | N | N |
| | Nitric Acid | Y | Y | Y |
| | Phosphoruc Acid | Y | Y | N |
| | Sodium Thydroxide | Y | Y | Y |
| 236. | Lead Cyanide | N | N | N |
| | Lead Nitrate | Y | N | Y |
| | Copper Nitrate | Y | N | Y |
| | Copper Cyanide | N | N | N |
| 237. | Hydrazine | Y | Y | N |
| 238. | Arsenic Trichloride | N | N | Y |
| 239. | Lead Salts | 5 | 1 | 14 |
| | Mercury Salts | N | N | 6 |
| 240. | Tetramethyl Lead | Y | Y | Y |
| | Tetramethyl Lead Gasoline | N | N | N |
| 241. | Isoprene | Y | Y | Y |

continued

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*EPA - Manual for Control of Hazardous Spills - Volume 1

TABLE B-2. (continued)

|  | Waste Stream | OHM-TADS | CHRIS | EPA* |
|---|---|---|---|---|
| 242. | Allyl Alcohol | Y | Y | Y |
|  | Amyl Alcohol | Y | Y | N |
|  | Butanol | N | Y | N |
|  | Ethanol | Y | Y | N |
|  | Isobutyl Alcohol | Y | Y | N |
|  | isopropyl Alcohol | Y | Y | N |
|  | Methanol | Y | Y | N |
|  | Benzene | Y | Y | Y |
|  | Butadiene | N | Y | N |
|  | Carbon Tetrachloride | Y | Y | N |

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*EPA - Manual for Control of Hazardous Spills - Volume 1

# APPENDIX C

## SUMMARY OF STATE SPILL RESPONSE PROGRAMS

The following pages summarize the comments of state spill response personnel who were contacted during the course of this study. The information is not all inclusive but is intended to provide a broad overview of state response activities. The details by State are included later in this Appendix, after the general discussion.

### 1. Regulations Requiring Spill Notification

States had various regulations which could be pertinent to spill clean-up or response. Some had no legislation which was directly applicable, although the general nuisance or water pollution control laws could be interpreted to apply to spill instances. In other instances, actual oil or hazardous spill legislation has been adopted; and sometimes broad hazardous waste laws have been defined to include hazardous spills as non-permitted generation of hazardous wastes. However, these laws are not as common as general water pollution laws which cover any discharge of pollutants into the defined "waters of the State". Some States indicated that they did not need any specific spill regulations since the federal laws were sufficient.

It should be noted that more legislation may be applicable but was not indicated by those who are involved in spill clean-up. Since most spill response personnel felt that hazardous wastes were covered under their general legislation, further inquiries into other appropriate laws were not considered necessary.

### 2. Materials Covered (applicability to Hazardous Wastes)

Few states require direct notification of specific hazardous waste spills, however, most people felt that hazardous waste spill incidents would be covered under whatever type of legislation required notification.

### 3. Land Spills

Depending on both the type of legislation and the basic definition of "waters of the state", land spills may or may not be covered by specific State legislation. However, more land spills were covered by State laws than under Federal requirements.

## 4. Definitions

Most State laws had definitions pertinent to their type of legislation. In some, common terms such as spill, emergency, waste, hazard were defined, while no specific information was included in others.

## 5. Number of Spills Reported

The number of spills reported was dependent on many factors including notification requirements, types of materials and locations covered, and whether or not minor or medium spills were included in the compilation. There was not a uniform definition of major or minor. The number of reported spills per year ranged from 10-3,000 events, depending on the State.

## 6. Types of Spills

Many spills were oil but again the percentages varied with the response. Basically, 50-95% of the reported spills were oil.

## 7. Notification Procedures

Most states did require some type of notification in the event of a spill, although it was not unanimous. The most common procedure was the use of a "hot line" manned by an operator on a 24 hour basis. The number was publicized to emergency response personnel, haulers, conservation agencies, industries and others. Generally, the operator is responsible to contact a designated staff member "on call" for the given time period. Some States have district officers assigned to spill response rather than a centralized agency staff member.

An alternative procedure is to distribute home call-lists for notification during non-duty hours. The spiller or other reporting person must call the names on the list until someone has been notified. In one state, notification of the state police was considered sufficient.

After the notification, the type of response will vary significantly. In some States, all spills are responded to, however, this is not common. Most spill response personnel consider the type and quantity of material spilled, as well as location before determining the type of response. Some have developed a general criteria to use in evaluating response modes but this is not usually available to outside personnel. Further notification may be done by state personnel to the EPA, Coast Guard, Civil Defense etc., depending on spill location and severity.

## 8. Required Reports

The states varied in their requirements for written reports. In some instances, there is a consistent legal obligation for the spiller to file a report, while in others the requirement is determined by state response personnel on a site specific basis. Often the request to file a report was established by the severity of the spill incident. The reports generally include the following information:

Section A.) Circumstances which caused the spill incident.
Section B.) Containment and clean-up actions which were taken with regard to the spill event.
Section C.) What was done to prevent future occurrences of spills caused by similar circumstances mentioned in the first section of the report.

When States did not require reports from the spiller, there were two main reasons:

1. On site State personnel would prepare an adequate report.
2. There were no requirements and the State did not see the usefulness of spill reports.

## 9. Use of the Response Teams

Most States did not do the clean-up themselves but usually hired a third-party contractor to perform the tasks. At times government or private response teams were involved in a clean-up incident, but the frequency of their use was quite low.

The use of third-party contractors was common, although most states required the industry or spiller to hire them. Often states had available lists of contractors for spill clean-up or hauling, however, most were oil spill contractors. Contacts indicated that less than ten firms were available with the capability to clean-up hazardous material spills.

Industrial and government response teams mentioned included EPA groups, U.S. Coast Guard Strike Teams and some industrial mutual aid groups; few names were indicated. The State personnel were happy with these teams but found that it was not necessary to use them very often.

## 10. Use of Information Sources and Spill Manuals

The only information source mentioned with any frequency was CHEMTREC. Those using it had differing comments but the majority liked the source. Of special note was the fact that this information source provided the name of the product manufacturer which was very desirable for response personnel. Usually the State people went directly to the manufacturer if they needed more detailed information. Commonly, states had their own in-house libraries and staff experts on whom they relyed, rather than depending upon outside data banks.

Very few response manuals were used. Some utilized the contingency plans, others used the EPA Field Detection and Damage Assessment Manual, which was well-liked. Response personnel sometimes had access to the DOT Emergency Response Manual or CHRIS but some were not aware of these resources or could not obtain them. OHM-TADS was unfamiliar or unavailable to almost all States and the EPA Manual was not yet published and distributed at the time of this study. Some states had developed their own response manuals which they used, however, these were not generally available to outsiders.

## 11. Hazardous Waste Handling

The use of State solid waste or hazardous waste sections varied in the State. Most spill personnel indicated that they coordinated their efforts with this group when appropriate. This practice was most common when locating a proper ultimate disposal site for the clean-up residues. In some states, the hazardous waste people were involved in all responses.

## 12. Use of Placards for Identification

State responses varied considerably. In many instances, State personnel were not affected by identification techniques since the spilled material was usually identified by the time they were contacted. Therefore there was no opinion with regard to placarding. When personnel did have an opinion, it was contradictory. Some felt placards were very helpful in identifying hazardous properties of chemicals, while others felt that the information from a placard was not detailed enough and sometimes misleading.

STATE: ALABAMA
(based on telephone conversation)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: (1) Civil Defense
(2) State Police
(3) Railroad
No telephone numbers were given.
The State will also notify the EPA.

REPORT: Responsible official fills out report.

PENALTY: $10,000/day for failure to notify the state.

PERTAINS TO: Any type of spill.

COMMENT: There were approximately 50 spills in the State's waters last year. Third-party contractors clean up spills. The State will work with the U.S. Coast Guard's Response Team. The State will only respond to spills which threaten water.

STATE: ARIZONA
(based on telephone conversation)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: During working hours one telephone number is used. For non-working hours five home telephone numbers are listed. No telephone numbers were given.

REPORT: None indicated.

PENALTY: None indicated.

PERTAINS TO: Water spills are responded to. A land spill is left untouched unless it is toxic or threatens any natural waters.

COMMENT: Approximately 30 spills occurred in 1977. Most of the spills involve oils or hydrocarbons.

STATE: ARKANSAS

Act 421 of 1977
The Hazardous Materials Transportation Act of 1977

Hazardous material means any substance or mixture of substances which is toxic, corrosive, an irritant, a strong sensitizer, or flammable, generates pressure through decomposition, or has been defined as such by the United States Government.

LICENSE REQUIREMENTS: None indicated.

NOTIFY: Police or State Highway Patrol
In the event of a spill the State requires that the Department Transportation be notified.

REPORT: No written report needs to be submitted to the State. However, one for EPA Region IV Report must be completed.

PENALTY: Illegal discharge is a misdemeanor.
$1,000 and/or 30 days in jail.

PERTAINS TO: Hazardous materials and hazardous wastes transportation.
Land, water, air.

COMMENT: Spill cleanup is private responsibility. Approximately 100 spills occurred in 1977 half of which involved oil or hydrocarbon. The State will respond to oil spills including those occurring on land.

STATE: CALIFORNIA

Health and safety code--Division 20 (Ammended September 1977)
Chapter 6.5 Hazardous Waste Control
(Hazardous Waste Control Law)

Title 22 Environmental Health
Division 4. Environmental Health
(Hazardous Waste Reguiations)

LICENSE REQUIREMENTS: The State Department of Health registers all business involved in handling hazardous wastes. The registration fee is $50.

NOTIFY: Not discussed. Both Law and Regulations do not address hazardous waste spills.

REPORT: None indicated for reporting a hazardous waste spill.

PENALTY: Article 8 of the Law addresses enforcement. Violations, such as illegal discharges, non compliance, are subject to a $25,000 fine. Violators can be imprisoned for up to one year. Unauthorized discharges can be treated as a violation of the Law and/or handled as a civil suit. A $5,000 fine is assessed for disposal without a permit, misrepresentation or violating any regulation.

PERTAINS TO: The handling, storage, use, processing, transportation and disposal of hazardous wastes.

COMMENT: Specific attention is given to the transportation of hazardous wastes. Although hazardous waste spills are not discussed specifically. Spills including those involving hazardous wastes are covered under separate legislation.

STATE: COLORADO

LICENSE REQUIREMENTS: None indicated.

NOTIFY: Colorado has a 24-hour emergency telephone number. The call is screened in order to direct the proper state agency to reply to the emergency. Within the Water Quality division one of the engineers is on call. A judgement can be made to respond to the spill and turn-around time is normally 3-4 hours. The state highway patrol is also involved in spill notification.

REPORT: The on-scene coordinator documents the spill.

PENALTY: Fines are levied in relation to their volume and damage. Most violations are considered for failures to report a spill, rather than for an actual spill. A person who violates a provision of any permit issued under the Water Quality Act is subject to a penalty of not more than $10,000 per day.

PERTAINS TO: Colorado has only had truck transport problems which mainly involve spills on land.

COMMENT: Both the EPA and the Division of Water Quality respond to spills. Colorado's Pesticide and Air Pollution Control Acts discusses prohibited discharges. A disaster emergency service is in existence for the purpose of aiding and abating man-made catastrophes. The Water Quality Control Act deals with emergencies along with nuclear, toxic and radioactive wastes.

STATE: CONNECTICUT

Public Act 765 (1969)
An Act concerning the Oil Pollution of Connecticut Waters.

This act now listed in the general statutes of the state of Connecticut as §§25-54 bb-kk discusses pollution of waters of state by oil.

"Oil means any floating oil of any kind or in any form including but not limited to fuel oil sludge, oil refuse and oil mixed with other matter".

LICENSE REQUIREMENTS: Those collecting disposal of waste products (includes oil) must have a permit from Commissioner of Environmental Protection.

NOTIFY: Department of Environmental Protection, Water Compliance and Hazardous Substances, State Office Building, Hartford, CT (203) 566-3338 (8:30-4:30)

Department of State Police, Hartford, CT (203) 566-4240 (all other times)

Effective January 1, 1977
National Response Center, Washington, DC (800) 424-8802

REPORT: Report of Petroleum or Chemical Product Discharge, Spillage, Seepage, Filtration is to be filed with:

filed with Department of Environmental Protection (DEP)
Water Compliance and Hazardous Substances
State Office Building
Hartford, CT 06115

PENALTY: $1,000 to $5,000 for failure to report a spill.
Liable for all damages, costs and expenses incurred.

PERTAINS TO: Pollution of land and water in state by oil.

COMMENT: There are nearly a dozen oil spill clean-up contractors in the area. A list of these oil spill clean-up contractors is kept. DEP keeps track of all spillage of oil, chemicals and hazardous substances which are covered under the Oil Pollution Act of 1969. Approximately 550 spills were reported from mid-1976 to mid-1977.

STATE: DELAWARE

Senate Bill No. 300
Chapter 62. Oil Pollution Liability.

"Oil shall mean petroleum, including crude oil or any fraction or residue therefrom. Oil pollution shall mean any discharge of oil that results in a film on, emulsion in, or sludge beneath the waters of the state of Delaware or its shoreline".

LICENSE REQUIREMENTS: None indicated.

NOTIFY: A 24-hour telephone number is available. In turn, the operator notifies the on-duty officers. The Environmental Protection officer coordinates the clean-up.

REPORT: A report is required after clean-up.

PENALTY: The bill discusses liability for oil pollution. Liability limits are discussed for the transport of oil on land or water and a $50 million limit is set for an industrial facility which is a source of oil pollution. Any vessel which uses state waters must demonstrate financial responsiblity in order to satisfy the maximum amount of liability.

PERTAINS TO: Spills on land and water.

COMMENT: Delaware puts responsibility on the polluter. If the state has to assume responsibility for the clean-up of an oil spill, the secretary of the Department of Natural Resources and Environmental Control has the power to assess the polluter for damages. Approximately 100 spills occurred in 1977, most of which involved oil.

STATE: GEORGIA
(based on telephone conversation)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: There is a 24 hour telephone number in existence to allow the responsible party to contact the State of the earliest possible moment.

REPORT: A report is often requested of the responsible party. The content of the report varies on a case by case basis.

PENALTY: None indicated.

PERTAINS TO: Water spills. Land spills are responded to only if a waterway is threatened.

COMMENT: Approximately 100 serious spills occur per year.

end

STATE: IDAHO
(based on telephone conversation)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: No present notification requirements. The State has an in-house committee which has a draft of a response plan of spill situations and will have regulations.

REPORT: Reports are required.

PENALTY: None indicated.

PERTAINS TO: Not indicated.

COMMENT: Most spills involve petroleum products and number less than a dozen per year. Hazardous wastes are covered in the regulations.

STATE: ILLINOIS

The Environmental Protection Act (1970)

Illinois Pollution Control Rules and Regulations
Chapter 3: Water Pollution (1977)

Various sections of Chapter 3: Water Pollution discuss relevant regulations pertaining to spills of hazardous materials.

LICENSE REQUIREMENTS: None indicated for the hauling of hazardous materials.

NOTIFY: Illinois Environmental Protection Agency (IEPA)
Division of Water Pollution Control
2200 Churchill Road
Springfield, Illinois 62706
Emergency 24-hour hotline telephone number: (217) 782-3637

REPORT: Caller should note: description of material, exact location, quantity of material spilled and type of container, time of spill, estimated direction of spill, anticipated adverse effects of spill, personnel at scene and action by personnel at scene.

PENALTY: None indicated.

PERTAINS TO: Water and Land spills. Saturated soil must be hauled away. Hazardous wastes are covered in the regulations.

COMMENT: The Illinois Environmental Protection Agency has a one page sheet which can be mailed entitled, "Emergency Reporting Procedures for Oil and Hazardous Material Spills".

STATE: INDIANA

Stream Pollution Control Board
Regulation SPC 17 (effective December 9, 1974)
Industrial Waste Hauler Permit Regulation
Liquid or Solid Industrial Waste: Any waste material resulting from industrial activity.

LICENSE REQUIREMENTS: All persons creating, hauling, and accepting wastes must be licensed.

NOTIFY: In an emergency, Secretary of the Indiana State Board of Health. Responsible party reports to the State spill section office 24 hours/day. The State then notifies (1) water supply section, (2) EPA, (3) County Health Department, (4) Conservation Department and (5) other pertinent agencies.

REPORT: Records must be kept of the transportation of any waste for a period of 3 years. After all spill operations are over, a formal report should be submitted.

PENALTY: $10,000 per day of violation under
IC 1971, 13-7
The Environmental Management Act of Indiana, as amended.

PERTAINS TO: Water, land and air.

COMMENT: Regulations SPC 15 or SPC 18 allows a person to accept liquid industrial wastes for disposal or treatment from a waste hauler. 133 spills were reported last year. Spills may not be reported by spillers. Hazardous wastes are covered in the regulations.

STATE: IOWA
(based on telephone conversation)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: A 24 hour answering service exists.

REPORT: Reports are required after clean-up.

PENALTY: None indicated.

PERTAINS TO: Land spills, water spills and fires also.

COMMENT: Approximately 250 spills occurred last year. Petroleum products are involved in 2/3 of the spills. Hazardous wastes are covered in the regulations.

3 OF

STATE: KANSAS

Kansas State Board of Health
Regulations
28-16-27: Pollution Spills and By-Passes (May 12, 1969)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: Oil spills are reported to the Division of Environmental Health, Kansas State Department of Health 53 South Kansas Avenue, Topeka, KS, (913) 862-9360, or the Department's area office. At other times field personnel should be called directly.

REPORT: Discharges shall be reported to the state department of health and environment. Written reports should be sent to either Topeka or the area office. It may be brief but should include the data, location, cause of spill, type of spill, quantity spilled and the method and effectiveness of the clean-up.

PENALTY: None indicated.

PERTAINS TO: Pollution spills in state waters and oil spills on land and water.

COMMENT: The Kansas State Board of Health has changed its name to the Kansas Department of Health and Environment. Several hundred spills were reported in 1977.

STATE: KENTUCKY
(based on telephone conversation)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: In the event of a spill, the responsible party should contact the state immediately. This can be accomplished via. a 24 hour/day telephone number. Efforts are made periodically to remind the public of this service.

REPORT: A written report is to be submitted to the State describing the spill as well as what is being done to prevent a report of the incident.

PENALTY: None indicated.

PERTAINS TO: Land spills are responded to depending on the severity.

COMMENT: Between 600 and 700 spills are reported each year. Most of these are not serious spills. Hazardous wastes are covered in the regulations.

STATE: LOUISIANA
(based on telephone conversation)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: There are no regulations concerning the notification of authorities about the spillage of a hazardous substance. An individual is only required to report any discharges which the state has not authorized. However, the responsible party is asked to contact the Stream Control Office by calling a 24 hour/day telephone number.

REPORT: None indicated.

PENALTY: None indicated.

PERTAINS TO: Not indicated.

COMMENT: Most reports involve pipeline breaks or spills, with less than 10 barrels of oil having been spilled. There are few major spills.

STATE: MAINE

Maine Revised Statutes Annotated, Title 38, Chapter 3. October 1977.

Concerns pollutants of any type (sewage, chemical, rediological, solid, petroleum, thermal, etc).

LICENSE REQUIREMENTS: Needed for any discharge into state waters.

NOTIFY: The State has a 24 hour telephone number which is well distributed. This number is intended for oil spills.

REPORT: None indicated except those needed for acquisition of a discharge permit.

PENALTY: Criminal: $25,000 per day of violation
Civil: $10,000 per day of violation
$10,000 fine and/or 6 months in jail for falsification and tempering.

PERTAINS TO: Land and water.

COMMENT: It is the responsibility of the Commissioner of Environmental Protection to detect hazardous waste and use his authority to enforce its safe disposal. Approximately 400 spills per year are reported.

STATE: MARYLAND

Title 8 Natural Resources Article
Annotated Code of Maryland (1974 Volume)
Water pollution control regulations 08.05.04.01., 08.05.04.07

LICENSE REQUIREMENTS: All operations involving transport, transfer, handling, and storage of oil must have a permit.

NOTIFY: Navigable waters: U.S. Coast Guard National Response Center
(800) 424-8802
Non-navigable waters: U.S. Environmental Protection Agency
(215) 597-9898
All state waters: Maryland Water Resources Administration
(301) 269-3551 (office hours)
(301) 269-3181 (other hours)

REPORT: The initial report (which may be made in person, writing or by telephone) required for an oil spill or a discharge should include the following: (1) time of discharge, (2) location of discharge, (3) type and quantity of oil, (4) assistance required, (5) name, address and telephone number of person making the report, and (6) all other important information. A written report must be submitted after clean-up and removal has been completed.

PENALTY: None indicated.

PERTAINS TO: Oil spills in water. Land spills are also covered since they can threaten water.

COMMENT: Control and removal of the spilled oil is the responsibility of the person involved with the illegal discharge. Approximately 3,000 oil spills occur annually. Problems exist with the identification of a spilled substance. Hazardous wastes are covered in the regulations.

STATE: MASSACHUSETTS

Regulation Booklet - January 11, 1973
Hazardous Waste - Waste substances which because of their chemical, radioactive, flammable, explosive, or other characteristics, constitute a danger to the public health, safety or welfare or to the environment (Classification given on Page 5).

LICENSE REQUIREMENTS: Dumping site must be state approved, annual license needed for those who transport hazardous waste.

NOTIFY (for oil only): Commonwealth of Massachusetts:
Hazardous Waste Board
Water Resources Commission
Division of Water Pollution Control

Person causing spill is responsible for having immediate corrective action taken.

REPORT (for oil only): Date, time, place of oil spill or discharge.
Type and amount of oil lost.
Cause of spillage.
Action taken to prevent recurrence.

PENALTY: $5,000 or 6 months in jail per violation.

PERTAINS TO: Water and land.

COMMENT: 90% of the reported spills involve oil. Hazardous wastes are covered in the regulations.

STATE: MICHIGAN

The Michigan Water Resources Commission Act (Act 245 as ammended) Part 5 of rules: Spillage of oil and polluting materials.

LICENSE REQUIREMENTS: None indicated.

NOTIFY: The Department of Natural Resources Emergency Response System is to be notified in the event of a spill. It is operated on a 24 hr/day, 7 day/week basis. Response is specific to each spill.

REPORT: Reports are required to be submitted by spiller and within 10 days. Reports are filed by the spiller and by the Department of Natural Resources.

PENALTY: None indicated.

PERTAINS TO: Not indicated.

COMMENT: Response depends on the amount of a spill and whether it affects surface or groundwater. Response is immediate for surface water spills. 1,450 spills were reported in 1977. 10-15% are hazardous material spills.

STATE: MINNESOTA

Statue 115.06 I
Applies to anyone who has had a pollutant spill, leakage or discharge.

LICENSE REQUIREMENTS: None mentioned in this brief summary.

NOTIFY: Minnesota Pollution Control Agency immediately:
24-hour telephone (612) 296-7373.

REPORT: Advice during spill is offered, as well as final method of waste disposal requires approval.

PENALTY: None mentioned here.

PERTAINS TO: Land, water and air.

COMMENT: Copy of statute is not available, only a one page summary was accessible. About 1,000 spills per year are reported. 90% of the spills involved oil. Many of the incidents involve subsurface storage tank leaks.

STATE: MISSISSIPPI

LICENSE REQUIREMENTS: See comment.

NOTIFY: The Department of Pollution Control and Ecology handles water and air pollution. The Health Department handles solid waste and drinking water. The Highway Patrol is usually first on the scene of an accident. After hours the Civil Defense Emergency operation center contacts the Director of Enforcement for the Air and Water Pollution Control Commission.

REPORT: None indicated.

PENALTY: A spiller must at least reimburse the department for clean-up costs.

PERTAINS TO: Spills on land and water.

COMMENT: Under the Solids Wastes Disposal Law of 1974, hazardous wastes are required to be disposed of in landfills or incinerators separate from ordinary wastes as determined by the health department or other responsible agency.

STATE: MISSOURI

Title 10-Department of Natural Resources
Division 20 - Clean Water Commission
Chapter 5 - Hazardous Materials

LICENSE REQUIREMENTS: None indicated.

NOTIFY: Any person discovering a spill should immediately notify the Missouri Clean Water Commission. All reports of spills and discharges should be made by telephone (319) 751-3241. This number is available 24 hours a day.

REPORT: Nothing indicated.

PENALTY: Nothing indicated.

PERTAINS TO: Spills in water.

COMMENT: Approximately 250 spills are reported annually.

STATE: MONTANA

State Department of Health and Environmental Sciences
Environmental Sciences Division
Water Quality Bureau

MAC 16.2.14(10) - S14480 Water Quality Standards

LICENSE REQUIREMENTS: None indicated for the transportation of hazardous materials.

NOTIFY: There are telephone numbers to call for radioactive materials, stream pollution, gases and volatile substances, pesticides and chemicals. These numbers are to be used in the event of highway spills.

REPORT: None indicated.

PENALTY: Penalties for violation of provisions, rules, permits, effluent standards are $10,000 per day for a civil penalty, $25,000 per day or 1 year imprisonment is the penalty for not getting a permit to discharge for an initial violation. Subsequent violations are $25,000 per day or 2 year imprisonment.

PERTAINS TO: Surface water and ground water.

COMMENT: The Water Quality Bureau has an Oil and Hazardous Materials Pollution Control Contingency Plan. Approximately 50 spills are reported annually. 10% are major spills and 10% involve hazardous materials. Most spills involve petroleum products.

STATE: NEW HAMPSHIRE

Laws Relating to the Water Supply and Pollution Control Commission June 1976.

LICENSING REQUIREMENTS: None Indicated.

NOTIFY: Water Supply and Pollution Control Commission who will oversee cleanup.

REPORT: The State asks for a general report describing what happens, cleanup and what is done to prevent future incidents.

PENALTY: Double the amount of liability, plus possible felony charges to responsible person.

PERTAINS TO: Spills in water.

COMMENT: Cleanup is a private responsibility. Approximately 50 oil spills are reported annually.

STATE: NEW JERSEY

Docket No. DEP 004-77-01:
Rules concerning discharges of petroleum and other hazardous substances.

"Spill" or "spillage" means any escape of hazardous substances from the ordinary containers employed in the normal course of storage, transfer, processing or use. A "spill" becomes a "discharge" only when hazardous substances reach waters of the state or lands from which they might flow or drain into said waters.

LICENSE REQUIREMENTS: None, but all persons who intend to engage in the clean-up of discharges are required to submit relevant information to the Division of Water Resources.

NOTIFY: Department of Environmental Protection
Division of Water Resources
P.O. Box 2809
Trenton, New Jersey 08625
Attention: Discharge confirmation

N.J. Bureau of Water Pollution Control
Hotline: (609) 292-7172
Oil and Hazardous Materials
Program: (609) 292-5560

REPORT: Required within 60 days, including a description of the discharge incident, the source of the discharge, a description of the measures taken to clean up and remove the discharge and any steps planned or already taken to prevent a recurrence of the discharge incident.

PENALTY: $25,000 for deliberate negligence
$2,500 is the minimum penalty.

PERTAINS TO: Spills in water and on land which threaten water.

COMMENT: Approximately 1,300 spills, of which 80% are petroleum related, occur annually.

STATE: NEW MEXICO

Senate Bill 219, Chapter 313
Approved April 7, 1977

Hazardous waste is defined as any chemical or combination of chemicals intended for disposal. Relinquishes authority to "Oil Conservation Commission" in overlap.

LICENSE REQUIREMENTS: Disposal sites need licensing.

NOTIFY: Environmental Improvement Agency or the State Police.

REPORT: None indicated.

PENALTY: Criminal: $5,000 or 1 year imprisonment for violation.
Civil: $1,000 per day of violation.

PERTAINS TO: Water, land and air.

COMMENT: Currently, the Environmental Improvement Agency has proposed Hazardous Waste Regulations. Most spills involve oil and about 10 spills are reported annually.

STATE: NEW YORK

New York Codes Rules and Regulations
Title 6: Department of Environmental Conservation

LICENSE REQUIREMENTS: A spill clean-up contractor must be registered with the New York State Department of Environmental Conservation under Part 364, title 6 of the New York Codes Rules Regulations (NYCRR).

NOTIFY: A 24 hour answering service exists.

REPORT: Report is to be filled out by the state people.

PENALTY: None indicated.

COMMENT: The New York State Department of Environmental Conservation puts out a Water Quality Accident Handbook which covers notification and surveillance, containment and counter measures, clean-up, recovery and debris disposal, investigation and enforcement, regional contingency plans and additional technical information. The handbook was unavailable for review but a copy of the Table of Contents was received and was found to be extensive in the coverage of a pollutant spill in water. Hazardous wastes are covered by the regulations.

STATE: NEVADA
(based on telephone conversation)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: Not indicated.

REPORT: A report must be filed with the state within 10 days describing the procedure followed in preventing the spill material from reaching any body of water. The steps to be taken to prevent a recurrence of the problem should also be included in the report.

PENALTY: None indicated.

PERTAINS TO: Not discussed.

COMMENT: Between 10 and 20 spills per year are reported. The State requires that hazardous waste landfill sites be approved. Hazardous wastes are covered in the regulations.

STATE: NORTH CAROLINA

Article 21A: Oil Pollution Control Act of 1973
143-215.75 to 143-215.101

LICENSE REQUIREMENTS: Any person who desires to discharge oil onto state land or into state waters must secure a permit from the Environmental Management Commission. Permits will not be issued to those facilities having an adverse environmental effect on water quality, flora and fauna.

NOTIFY: The state Environmental Management Commission should be notified in the event of an oil spill.

REPORT: The state Environmental Management Commission should receive a report describing the discharge of oil.

PENALTY: There are civil and criminal penalties. A person can be fined up to $5,000 per day for each violation. Also, a violater can be guilty of a misdemeanor which could lead to imprisonment of up to 6 months or by fine not to exceed $10,000.

PERTAINS TO: Oil discharges onto state land or into state waters.

COMMENT: The state Environmental Management Commission can inspect facilities for compliance with the Act. A person who violates the act is liable for damage to public resources. Approximately 100 spills are reported annually. Most spills involve oil. Hazardous wastes are covered in the legislation.

STATE: NORTH DAKOTA
(based on telephone conversation)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: A notification number is in existence.

REPORT: A report must often be submitted to State officials for serious spills. The size of the spill is used to gauge its seriousness.

PENALTY: None indicated.

PERTAINS TO: The State will respond to hazardous material spills on land but generally does not respond to oil spills on land.

COMMENT: Approximately 100 spills per year are reported. Most of the incidents reported are small oil spills.

STATE: OHIO
(based on telephone conversation)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: Two numbers are provided for notification. Both are an answering service which gets pertinent information.

REPORT: None indicated.

PENALTY: The penalty is $10,000 to $25,000 per day for not ameliorating a spill.

PERTAINS TO: Anything that degrades or threatens a waterway.

COMMENT: Approximately 1,500 spills are reported annually. 50% involve hydrocarbons and 20% involve other chemicals.

STATE: OKLAHOMA

Environmental Permit Directory
Oklahoma Department of Pollution Control
Publication No. 90

Oklahoma Oil and Hazardous Substances
Pollution Contingency Plan

Hazardous polluting substances are defined as elements or compounds other than oil which when discharged in any quantity to the waters of the state threaten the natural environment and the public welfare or safety.

NOTIFY: Notification will be made initially be telephone followed by a written report. The appropriate agencies are listed in the Pollution Contingency Plan.

REPORT: A written report should contain the following information: location, material discharged and amount, stream affected or endangered, cause or probable cause of discharge, steps taken for removal and measures taken to insure the discharge cannot reasonably recur. The written report is to be made to the appropriate agency within ten days after the discharge is first reported.

The on-scene coordinator (OSC) must also file a report at the conclusion of the state activity. A specific Discharge Report Form is given in the Contingency Plan.

PENALTY: None indicated

PERTAINS TO: Oil and hazardous substance spills.

COMMENT: The Contingency Plan does not deal specifically with notification and reporting procedures. Oklahoma does have a state response team and its members are listed along with state and federal agencies. The Permit Directory lists government procedures and permits for state and federal environmental management agencies. Major spills are from oil well accidents.

STATE: OREGON

Oregon Accident Response System (OARS)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: First person on the scene calls local police, fire or other emergency group if necessary. Then he calls the state police at Salem (503) 378-3071 and Emergency Services (800) 452-0311. CHEMTREC, (800) 424-9300 can also be called.

REPORT: Various parties are responsible for reports, whether they be a chemist who reports on the analysis of a spilled substance or a foreman who works for the Highway Division. Response team files a report with the OARS Clearing House Council.

PERTAINS TO: Spills in the state of Oregon.

PENALTY: None indicated.

COMMENT: Oregon has put out a book on its Accident Response System.

STATE: PENNSYLVANIA

Title 25 Rules and Regulations
Part I Department of Environmental Resources
Subpart C Protection of Natural Resources
Article II Water Resources
Chapter 101 Special Water Pollution Regulations

Public Law 657: Hazardous Substances Transportation Act

Hazardous substance is defined as flammable liquid or solid, an oxidizing substance, corrosive liquid, compressed gas, a poisonous or radioactive substance, explosive, molten metal or similar substance.

LICENSE REQUIREMENTS: None indicated.

NOTIFY: The Department is to be notified at regional offices. After business hours the Capitol operators at Harrisburg (717) 787-2121 will receive telephone calls if unable to contact regional offices of the Department of Environmental Resources.

REPORT: None indicated specifically for hazardous waste spills. However, industrial discharges which are improperly or inadequately treated must be reported.

PENALTY: Violations of the hazardous substances transportation act are subject to fines up to $500 or imprisonment up to 30 days for operators of vehicles. Shippers, carriers or consignees face fines up to $5,000 or up to 60 days imprisonment for violations. Violations are considered misdemeanors.

PERTAINS TO: Spills in water.

STATE: RHODE ISLAND
(based on telephone conversation)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: The State desires immediate notification. A 24 hour telephone number is maintained for this purpose.

REPORT: The State personnel who are on the scene of the spill, are responsible for submitting a report on the incident.

PENALTY: None indicated.

PERTAINS TO: The State responds to land spills and oil spills.

COMMENT: Approximately 75 spills are reported annually. Almost all spills reported involved oil.

STATE: SOUTH CAROLINA

Act No. 179
Approved June 13, 1977

Concerned with oil and gas and "physical waste as that term is generally understood in the oil and gas industry". Also included is pollution resulting from energy dissipation.

Pollutant means any emission that significantly deteriorates the quality of the air, water or land.

LICENSE REQUIREMENTS: Registration of all parties handling oil and its products is required.

NOTIFY: Department of Health and Environmental Control. Immediate notification is desirable. A 24 hour answering service is available.

REPORT: A copy of all records should be sent to the Department of Health and Environmental Control. The State often requests that a report be submitted even though there are no formal requirements.

PENALTY: None indicated.

PERTAINS TO: Water, land and air.

COMMENT: Regulations are restricted to oil, gas, and their by-products. Approximately 350 spills are reported annually. Hydrocarbons are involved in most spills in volumes varying from 1 to 10,000 gallons. Hazardous wastes are defined in Act No. 179.

STATE: SOUTH DAKOTA

SDCL 34-16B-4 Law

Oil and Hazardous Substances Pollution Contingency Plan

Hazardous and Toxic Wastes are defined as those wastes that require special handling to avoid illness or injury to persons or damage to property.

LICENSE REQUIREMENTS: Permits needed for operation of a sanitary landfill site, incinerator, or other disposal method.

NOTIFY: National Response Center (NRC)
Washington, DC
(800) 424-8802 24 hour telephone number

United States Environmental Protection Agency
Regional Response Center 8S-EP (RRC)
1860 Lincoln Street, Suite 103
Denver, CO 80295
(303) 837-3880

REPORT: The State generally requires information regarding the spill from the responsible party.

PENALTY: None indicated.

PERTAINS TO: Not indicated.

COMMENT: There are approximately 100 spills reported per year. 95% of all spills involve oil or related hydrocarbons. Hazardous wastes are covered under the legislation.

STATE: TENNESSEE
(based on telephone conversation)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: DOT, Civil Defense and the State Division of Water Quality Control.

REPORT: None indicated.

PENALTY: None indicated.

PERTAINS TO: Land spills are responded to when any body of water is threatened.

COMMENT: Approximately 200 spills are reported annually of which 60% involve hydrocarbons in some form.

STATE: TEXAS

Oil and Hazardous Substances Pollution Contingency Plan
- Texas Water Quality Board, revised April 1978

LICENSE REQUIREMENTS: None indicated.

NOTIFY: Notify one of the following agencies within 24 hours.

-Texas Water Quality Board
-Texas Railroad Commission
-Texas Parks and Wildlife Department

REPORT: Telephone reports should include names, location, type of material discharged, estimate of quantity, extent of pollution and steps being taken to contain and/or clean-up the spill. Telephone numbers to call are those mentioned above. Other agencies that could be contacted are the Texas departments of: Public Safety, Health; Air Control General Land Office, Governor's Office, EPA, and the Coast Guard. The following form is available: Oil or Hazardous Materials Accidental Discharge or Spill Report (WQB 100, revised 4-1-74).

PENALTY: The State of Texas can initiate legal action for injunctions, fines or damages against any party involved with the spill of a hazardous material.

COMMENT: The Texas contingency is well written and fairly complete. The discharger is responsible for cleaning up the hazardous material spill. Approximately 60 spills per year are reported. Crude oil, hazardous materials and hazardous wastes are representative of the materials involved in the spills. The new regulations include hazardous waste.

STATE: UTAH

Oil and Hazardous Spills Directory, August 1977

LICENSE REQUIREMENTS: None indicated.

NOTIFY: Environmental Protection Agency, immediately
Lincoln Towers
1860 Lincoln Street
Denver, Colorado 80203
24 hour telephone: (303) 837-3880

Environmental Health Bureau of Water Quality
150 West North Emple
P.O. Box 2500
Salt Lake City, Utah 84110
24 hour telephone: (801) 533-6145

REPORT: None indicated.

PENALTY: $10,000 or 1 year in jail for failure to notify the Water Quality Bureau in the event of a spill.
$5,000 for each offense.

COMMENT: A large list of sources of local help is supplied in the Directory. Approximately 100 spills are reported annually. About 50% of the spills involve oil or hydrocarbons.

STATE: VERMONT
(based on telephone conversation)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: The State is to be contacted during the working hours. The State police are to be contacted at other times.

REPORT: The State personnel at the spill scene determine whether or not the responsible party will be required to submit a report.

PENALTY: None indicated.

PERTAINS TO: Landspills are included in the current regulations when they threaten subsurface water.

COMMENT: Approximately 100 spills are reported in a year. 80% of the spills involve oil.

STATE: VIRGINIA

State Water Control Law
(Chapter 3.1 of Title 62.1:Waters of the State, Ports and Harbors, Code of Virginia 1950, as ammended).

LICENSE REQUIREMENTS: None indicated.

NOTIFY: No legal requirements exist which require notification. A 24-hour telephone number exists.

REPORT: None indicated.

PENALTY: None indicated.

COMMENTS: About 450 spills are reported per year. 325 of these spills involved oil.

STATE: WASHINGTON

RCW 90.48 Various sections reprinted in "Laws and Oil Spill Emergency Procedures"
-Department of Ecology

LICENSE REQUIREMENTS: None indicated.

NOTIFY: Both State and Federal authorities responsible for policing oil spills should be notified when oil is discharged into state waters. The Coast Guard, Environmental Protection Agency and the State Department of Ecology are listed as the agencies to contact.

REPORT: None indicated.

PENALTY: Any person found guilty of willfully violating any provisions of the chapter (RCW 90.48) can be fined up to $10,000 and incur the cost of prosecution. A violator is also liable for the total amount of damages caused by pollution. A violator can be fined up to $5,000 a day.

PERTAINS TO: Oil spills on land and in water.

COMMENT: The Washington State Department of Ecology has put out a small pamphlet that contains the state oil pollution control laws as they pertain to oil spills. Liability for damages, oil spill reporting procedures, oil spill cleanup procedures, oil spill cleanup firms, and the addresses (including telephone numbers) for various federal and state agencies involved in oil spill are also listed. Hazardous wastes are covered in the regulations. About 2,400 general spills are reported each year.

STATE: WEST VIRGINIA

Water Pollution Control Act
Chapter 20 - Article 5A
(Administrative Regulations State Water Resources Board)

LICENSE REQUIREMENTS: None indicated.

NOTIFY: The Division of Water Resources, State Department of Natural Resources should receive prompt notification by telephone in the event of a spill or an accidental discharge.

REPORT: None indicated.

PENALTY: The State must know why the spill occurred and methods used to prevent further damage.

PERTAINS TO: Spills in water

COMMENT: The Water Pollution Control Act does not address toxic and hazardous waste spills. Hazardous wastes are covered in the Water Pollution Control Act.

STATE: WISCONSIN

Assembly Bill 880
July 13, 1977
Hazardous Waste (Defined Pg. 27, 49)

LICENSE REQUIREMENTS: Persons engaged in the transportation, treatment, storage, or disposal of hazardous wastes are required to obtain an annual license.

NOTIFY: Division of Emergency Government
24 hour telephone (608)266-3232

REPORT: Submit report to the Department of Natural Resources with information on cause, containment, cleanup and disposal of spilled material.

PENALTY: $25,000 per day of violation and/or 1 year imprisonment.

PERTAINS TO: Water, land and air.

241

STATE: WYOMING

Wyoming Water Quality Rules and Regulations, 1976

"Hazardous Material" - Any matter of any descritpion or origin other than petroleum or radioactive products which when discharged presents an imment and substantial hazard to public health. (Separate and similar regulation concerns petroleum).

LICENSE REQUIREMENTS: None indicated.

NOTIFY: Environmental Quality Control
Water Quality Division

REPORT: Method of disposal needs approval. A written report must be submitted to the State within 7 days after the termination of the cleanup operation.

PERTAINS TO: Water.

COMMENT: About 100 spills per year are reported. 90% of the spills involve oil.

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